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THE EFFECTS OF ACTIVE LEARNING TECHNOLOGY ON INSTRUCTORS' PRACTICES AND STUDENTS' ENGAGEMENT AND GRADES: A MIXED METHODS STUDY

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THE EFFECTS OF ACTIVE LEARNING TECHNOLOGY ON INSTRUCTORS' PRACTICES AND STUDENTS' ENGAGEMENT AND GRADES: A MIXED METHODS STUDY

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Partly in response to university teachers' changing pedagogies marked by flipping instruction, lecture capture technologies are evolving into active learning systems. Little published research exists on the effects of active learning technology on either teachers or students. This two-phase sequential explanatory mixed methods study details the effects that active learning systems have on instructor practices and on student grades and engagement. Phase one combined quantitative data collection with instructor interviews. Phase one findings show higher student engagement levels correlate with the use of the active learning system only in the presence of very specific, flipped classroom practices. Phase two, a multiple case study, contextualizes those findings by detailing the students' experiences. Focus groups held within each of three bounded cases yielded multiple themes, which, coupled with the phase one results, led to five key findings. Primary among these findings are: 1) Active learning technology only correlates to higher engagement or grades when the teacher advocates frequently for the system's use and students use it often, and 2) students have positive perceptions of active learning technology, use it primarily to prepare for exams, and on occasion change their note taking or attendance behaviors. Three recommendations for future research and practice follow a discussion of these findings.

For Jill, Theo, and Lucy.

In memory of Clarissa.

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CHAPTER 1: INTRODUCTION

Active Learning Technology's Roots: Lecture Capture

The advent of the Internet has changed how we collect, disseminate, and consume information. These changes have been rapid, and their ramifications touch all elements of American society, from health care to entertainment. Of course, education at all levels has not been immune from these changes, in part because of the breadth of technology adoption among American youth. Nearly 90 percent of graduating high school students consider themselves frequent users of the Internet; these students rely on the Internet for nearly all of their communication, information-gathering, and social interaction (Hughes & Dennison, 2008). With specific regard to learning, students entering college expect to use technology to create and consume content, communicate about that content, and to demonstrate their understanding of the content (Green & Hannon, 2007). In response, teachers have incorporated a wide variety of classroom technologies into their college courses.

One such technology, the use of Internet-based tools to record and disseminate classroom videos, has grown in popularity. Teachers have long taken an interest in creating video recordings of their lessons in order to access them later. Initially instructors (or teacher education departments) used these recordings as a mechanism for reflection and evaluation of that teacher's practice (Wise, & Groom, 1996). Subsequently, as these recordings became more widely adopted, educators began to see instructional value in the videos. Teachers would use the videos to create visual demonstrations for use in other classes, and they would use the videos as a remediation

mechanism for struggling learners (Woo, Gosper, McNeill, Preston, Green, & Phillips 2008).

Over time, this classroom capture process became more robust. In the early years of this century, the intersection of three key technologies – widely available Internet access; low-cost, high-quality digital recording technologies (both hardware- and software-based); and the advent of online education – revolutionized electronic classroom capture. An entire industry arose around the technology. In higher education, this industry focused most directly on large, lecture-based classes; these companies branded their systems as "lecture capture solutions.' Lecture capture can be defined as any technology that allows instructors to record their lectures, convert the recordings into digital video files, and distribute the files to students for later viewing or review (Stroup, M. D., Pickard, M. M., & Kahler, 2012). Stroup et al. (2012) note that there are three primary ways that collegiate instructors utilize lecture capture systems: 1) as a back-up for students who missed class and need to view the material, 2) as a study aide that allows students to review material prior to exams, and 3) as a means to create content that can be used in online versions of the course. As costs of lecture capture systems have fallen and students' access to the Internet has risen, more and more universities have deployed lecture capture systems in their large enrollment classes (Owston, Lupshenyuk, and Widerman, 2011).

Although lecture capture has been used in various forms for well over a decade, the research surrounding the technology is limited. Studies of the technology are primarily focused on uncovering correlations between the use of the system and changes in student grades, or on describing students' perceptions of the technology. As a result,

though there is a developing picture of the degree to which lecture capture technology affects students' learning, there is little or no understanding as to why (or why not) such an effect exists. Few studies of lecture capture have asked more qualitative questions; those that have, such as the work by Taplin, Low, & Brown (2011), Cramer et al. (2007), Nicholson and Nicholson (2010), and Woo et al. (2008), focused on student or teacher perceptions of the technology. Though there are mixed findings with regard to the effectiveness of lecture capture systems' ability to improve student grades, there is wide agreement among researchers that students perceive lecture capture as useful.

There is a paucity of research assessing the degree to which lecture capture systems cause a modification in the practice of the instructors who teach using these systems and an equivalent lack of studies that uncover the relationship between the implementation of lecture capture and student engagement in the class. The overall lack of published research on the topic of lecture capture's effects on student engagement, and the absence of studies that seek to describe changes in instructor's pedagogical practices, means that there is a significant gap in our understanding of the full effects of lecture capture on the teaching and learning process.

Enhanced Lecture Capture: Active Learning Technology

To further complicate matters surrounding the research of lecture capture, in recent years instructors at various institutions have begun combining the use of lecture capture technology with additional teaching technologies, data collection mechanisms, and student engagement systems. These enhanced lecture capture systems combine the core functions of lecture capture (recording and re-distribution of the face-to-face class session) with other technologies. They bundle together classroom response systems,

online discussion forums, digital note taking, and lecture capture into a single tool in an effort to increase student engagement in lectures and provide measurable data surrounding that engagement. Classroom response systems have traditionally been stand-alone technologies allowing students to respond to polls, surveys, and quiz questions using a dedicated clicker device or (more recently) a smartphone or laptop. The student responses are projected in real-time in the classroom, and they are all fed into a central database for grading. Online discussion boards have traditionally been housed almost exclusively within the institutions' learning management system – the online learning portal that facilitates the aggregation and dissemination of course content through a course-specific website. Digital note taking has, until recently, been tied predominantly to e-texts and other digital publications. In these permutations, users can highlight text, bookmark pages, and type marginal notes for later review.

Now, enhanced lecture capture systems have combined all of these tools into a single technology, dubbed *active learning technology*. In such systems, instructors can pre-load their lecture slides into the system. These slides are then made available to the students on smartphones, tablets, or laptops as the lecture unfolds. The system allows the students to interact with the slides in the same way that an e-text allows for digital note taking: they can highlight areas of note on the slides, bookmark slides that they will need to return to, flag specific slides as confusing, and type notes. Additionally, students can use the discussion tool to post comments, questions, or responses to other's posts. Students can download these notes and discussion posts after the lecture concludes; the system compiles them all together into a digital study guide. The instructor, when uploading slides into the system, can add interactive slides with quizzes, polls, surveys,

or questions; the students can then use their connected devices to respond to the prompts when the instructor reaches that point of the lecture. Just as is the case with a traditional classroom response system, these responses are projected in real time, recorded, and fed to the instructor for later grading. While all of this is happening, the lecture capture system is still recording everything. After the lecture concludes, the recorded lecture, the annotated slides, and the discussions are all packaged together and uploaded into the course website. Students can then re-watch the lecture as they choose, continuing to interact with the discussion posts and interactive slides asynchronously.

Problem Statement

Active learning systems are so new to the learning technology field that little to no published information exists as to their effects on student engagement or their effects on student or instructor behaviors.

Purpose Statement

Active learning technology is largely under-studied, and it is very possible that a robust implementation of that technology will affect teachers' practices and students' engagement in class. The inclusion of a variety of engagement tools in these enhanced systems may foster student behaviors, which, in keeping with findings, should in turn result in improved outcomes on tests and in the course as a whole (Kiewra and Fletcher, 1984). Given the newness of active learning technology, it is prudent to conduct further research in this area. The purpose of this research is to investigate the degree to which the use of active learning technology changes teachers' practices, the degree to which it increases students' engagement in class, the reasons that any changes in engagement may or may not exist, and the ways in which students' behaviors change because of access to

the system. Prior to completing this study, I anticipated there to be a correlation between use of the active learning technology system and an increase in engagement, assuming that the participant instructors modify their teaching in such as was as to encourage the frequent use of the technology.

The study takes place in a diverse selection of large-enrollment undergraduate classes at a major Midwestern public university. Through this study, I seek to measure how and why an active learning system affects students' engagement and student and instructors' practices. I seek to uncover what motivates students to use (or disregard) active learning technology and how students use the technology. Furthermore, I explore students' perceptions on the benefits and drawbacks of active learning technology, their perceptions of the technology's effect on their learning and study habits, and their perceptions of the best possible uses of the technology. I endeavor to reveal if any differences in perception exist between students who choose to use active learning technology and those who do not.

I also identify themes in the instructor experience surrounding the use of active learning technology, and seek to uncover how these pedagogical changes can drive student use of the technology. Catherine Adams (2006) notes that the use of PowerPoint in teaching causes a change in the mindset of the teacher. The integration of a technology requires that the instructional content conform to the confines of that technology. In the case of PowerPoint, all presentations must be a linear presentation of images or bulleted text (Adams, 2006). Indeed as teachers become more accustomed to technologies, the very way that they think about the content that they teach changes (Parker, 2001). By extension, it is possible that other teaching technologies may have a similar effect. This

study will seek to identify any ways in which the implementation of active learning technology causes teachers to change their pedagogical practices or causes changes in the way that teachers think about their instructional content.

These findings provide a richer understanding of the ramifications of the implementation of lecture capture with active learning. This in turn may inform any training decisions that surround such an implementation, and allow institutions to make informed decisions about how to encourage instructors to make pedagogically sound use of the technology.

Pilot Study

This study builds on the design and findings of a pilot study that only tested the lecture capture portion of the active learning system. The mixed methods pilot study unfolded in two phases and followed the sequential explanatory design (Creswell, 2002), seeking to answer the following questions:

1) To what degree does the use of lecture capture technology affect student learning outcomes?
2) In what ways do students use lecture capture technology to change their approach to classes?

The first phase of the study focused on the collection of numeric data from three distinct sources: online surveys administered to the students twice during the semester, student grades on course tests and their overall grades in their course (collected from the course websites on the Blackboard learning management system), and student-use data of the Echo360 lecture capture system (collected from the administrative panel of Echo360).

These data in turn informed second, qualitative phase of the study. The qualitative portion of the study concerned itself less with the actual change in students' learning

outcomes, and more with why students used the lecture capture system, and what their experiences were when they did use it.

I employed three methods of data collection in this study. The first was a pair of questionnaires, which I used to collect student demographic data, student self-reported attitudes toward their courses, and student commentary on the lecture capture system. The second was the collection of raw data related to the test classes. These data consisted primarily of students' usage statistics pulled out of the lecture capture system and student grade data pulled out of the Blackboard grade center. I used both of these two data collection methods to inform the sampling process for the assembly of the two focus groups.

The focus groups formed the third, and primary, data collection mechanism. The focus groups were held in an empty classroom approximately two months after the test semester concluded. Each lasted 45 minutes. During the focus groups, I guided the discussion, allowing the participants to interact freely. A series of key questions formed the skeletal structure of the focus group sessions. I linked key focus group questions intrinsically to the core research questions. Following the procedures prescribed by Stake (2010), I recorded both focus groups, transcribed them, and analyzed the results independent of the other. Once I identified themes for each case separately, I compared the two sets of themes using a cross-case analysis (Stake, 2010). I then cross-referenced the responses of the focus group participants with data collected pertaining to course performance and lecture capture system use. Doing so allowed me to find connections between use rates, class performance, and the frequency of specific thematic responses in the focus group.

The distillation of the focus group sessions, course data, and lecture capture data into these key themes and patterns allowed me to reach conclusions about the students' response to the implementation of the lecture capture system. The findings of this pilot study revealed that across all eight test courses there was no correlation between system use and higher student grades. In certain courses in which the instructor specifically advocated for the frequent use of the lecture capture system, however, there was a positive correlation between student grades and student use of the system in classes. Table one details the descriptive statistics of all the students across all the pilot study classes.

	BIOS 1	**BIOS 2**	**LIFE 1**	**LIFE 2**	**MNGT**	**NUTR**	**PSYC 1**	**PSYC 2**
Grade	94.17 (7.98)	77.90 (15.56)	80.43 (12.20)	82.98 (8.63)	87.69 (9.12)	96.09 (6.18)	81.07 (13.52)	79.75 (13.27)
Mean Video Views	1.54 (5.18)	11.31 (13.12)	2.25 (6.60)	5.47 (5.52)	0.42 (1.67)	5.36 (8.77)	2.35 (4.95)	5.27 (7.98)
Total Students	182	236	245	226	190	258	423	128

Table 1: Pilot Study Means and Standard Deviations of Grades and Views by Course Including All Students (Note: parentheses contain standard deviations)

Table two details the descriptive statistics of views across all the pilot study classes with the non-users of the system removed.

	BIOS 1	BIOS 2	LIFE 1	LIFE 2	MNGT	NUTR	PSYC 1	PSYC 2
Mean Video Views	7.18 (9.29)	13.76 (13.26)	5.62 (9.51)	6.31 (5.46)	4.70 (3.41)	11.34 (9.75)	5.75 (6.36)	8.89 (8.68)
Total Students	39	194	98	196	17	122	173	76

Table 2: Pilot Study Means and Standard Deviations of Views by Course Excluding Nonuse Students (Note: parentheses contain standard deviations)

Table three details the correlations between use of the system and key dependent variables.

	Views	Nonuse	Attendance	Expected Grade (pre-course)
Grade	0.243* (226)	-0.282* (226)	-0.064 (175)	0.837* (175)
Views	- -	-0.389* (226)	-0.023 (175)	0.210* (175)
Nonuse	- -	- -	0.195* (175)	-0.175* (175)
Attendance	- -	- -	- -	0.002 (175)

Table 3: Correlations between Grade, Views, Nonuse, Attendance, and Pre-course Expected Grade (Note: * $p < 0.05$, parentheses indicate *n*.)

The key findings of this pilot study were that in courses in which instructors actively encouraged the use of the system, there is a correlation between total views and higher grades.

- Two courses (in which the instructor advocated frequently for the use of the system) showed significant correlations (.215, .245, $p<.05$)
- Six courses (in which the instructors made little or no reference to the system after the first day) showed no statistically significant correlation

Subsequent to the analysis of the quantitative data, I conducted focus groups to better contextualize the behaviors that characterized use of the active learning technology, to better understand students' perceptions of the system, and to clarify what training and support students needed to use the active learning system efficiently. I used the themes and patterns that emerged from these focus groups to inform the design of the final study

Designing the Main Study

The pilot study informed the design of the main study described herein. This main study explores the answers to the research questions in two phases. In phase one I collected quantitative data concerning the students' demographics, use of the technology, performance in the class, and engagement. This data collection took place in multiple classrooms over the course of one semester. Subsequent to that semester, I identified three groups of students; I defined these groups of students by the combination of two characteristics: their teachers advocacy for the use of the active learning system, and the overall frequency of use of the active learning system in their classes. These three groups formed three distinct, bounded cases (the high advocacy/high use case, the moderate advocacy/low use case, and the low advocacy/low use case). I modeled the formation of these three cases on the processes I followed in the pilot study. I conducted separate focus group conversations and interviews with these three case groups to assess the differences in the students' classroom experiences, their perceptions of the active learning technology, and their retelling of the nature of the instructors' practices. Additionally, I conducted interviews with the participating instructors to address questions pertaining to the teachers' perceptions of the technology and the ways that teachers changed (or did not change) their practices because of the implementation of the technology.

Research Questions

I designed the study as described above in order to fully address my core research questions:

1. How do instructors implement active learning technology?
    a. How do instructors change their practices when the technology is available?
    b. How do instructors perceive active learning technology and its utilization in their classes?
    c. How does using the technology change teachers' thinking about their own instruction?
2. How do various implementations of active learning technology affect student engagement and learning outcomes?
    a. How do students' engagement levels and exam grades correlate with different uses of active learning technology?
    b. How do students' behaviors in and out of class change when active learning technology is implemented in their classes?
        i. Why do students choose to utilize (or not utilize) the features of active learning technology?
        ii. How do specific pedagogical implementations of active learning technology affect students' use of and perceptions of the technology?
        iii. How do specific pedagogical implementations of active learning technology change students' thinking about their own learning?

Chapter three will describe in detail the design of the study, and how it addresses each of these two main questions and their sub questions.

Definitions

For the purposes of this study, I define the term engagement as a multidimensional construct consisting of behavior, cognition and affect (Frederick, Blumenfeld, & Paris, 2004; Reschly & Christenson, 2012). The operational definition of engagement, then, is a student's academic actions inside and outside of class (behavior); the student's acquisition of the course material (cognition); and the student's emotional investment in the course material, the instructor, and other classmates (affect).

For this study, I define lecture capture technology as any technology that allows instructors to record their lectures, convert the recordings into digital video files, and distribute the files to students for later viewing or review (Stroup, M. D., Pickard, M. M., & Kahler, 2012). Building off that definition, I define active learning technology as any technology that bundles together classroom response systems, online discussion forums, digital note taking, and lecture capture into a single tool in an effort to increase student engagement in lectures and provide measurable data surrounding that engagement.

Methodology

Because of the nature of the research questions, a mixed methods sequential explanatory research design that emphasizes the qualitative data is best suited for this study. The mixed methods sequential explanatory design consists of two distinct phases: quantitative followed by qualitative (Creswell, Plano Clark, et al., 203). In this design, I first collected and analyzed the quantitative data. I then conducted interviews with each of the participant instructors to help inform the formation of the focus group cases, and analyzed the qualitative data I collected from those interviews. I then formed the cases and, through focus group conversations, collected and analyzed the qualitative data second in the sequence; it helped explain, or elaborate on, the quantitative results obtained in the first phase.

The second, qualitative phase built on the first, quantitative phase, and I connected the two phases twice: first in the intermediate stage and again during the interpretation phase. The rationale for this approach is that analysis of the quantitative data and the data generated by the instructor interviews provided a clear picture of the

effects of active learning technology on teachers' practices (research question one), and a general understanding of the effects of active learning technology on student engagement and learning outcomes (research question two). In analyzing the qualitative data I explored participants' views in more depth, refining and explaining the quantitative results and further clarifying answers to research question two (Creswell, 2003; Rossman & Wilson, 1985; Tashakkori & Teddlie, 1998; Creswell & Plano Clark, 2011). This study concerns itself less with the actual change in student engagement and learning outcomes (though that was a significant element in the sampling approach for the study's focus groups), and more with why students used the active learning system, what their experiences were when they did use it, the nature of the way the system changed instructors' practices, and what role the instructors' use of the system had on the students' use rates and perceptions of the system. In that light, the priority (Creswell, 2003) of the study is on the qualitative findings, because they focus on in-depth explanations of the data collected in the first, quantitative phase. The quantitative and qualitative data mixed when I used the quantitative findings to inform selection of the focus groups, and to inform the development of the interview protocol for the qualitative portion; additionally, as I completed the final analysis of all the accrued data during the interpretation phase the data were mixed once more (Ivankova & Stick, 2007).

Limitations

The design and implementation of this study came with some inherent limitations, though I made every effort to minimize these. The convenience sampling procedure is one significant limitation. I worked with the university's classroom support team to install the Echo360 active learning system in five large general-purpose lecture halls. I

could not control which classrooms were selected, as the technical requirements of the system mandated that certain computer hardware and software configurations be present in the classrooms in which the system was installed. Of the rooms ultimately selected, the largest has a capacity of 400 seats and the smallest has a capacity of 150 seats. The rooms hold courses that represent a large cross section of the university's colleges and majors. I had no control over what courses were taught in the classrooms in which the technology was installed. I invited every teacher scheduled to teach in the selected rooms to participate in the study. The teachers who responded to the invitation and decided to use the technology in their teaching represented a wide array of colleges, and taught classes of varying levels in a wide range of subject areas. I had no control over what types of classes were taught, what level of courses used the technology, or the way in which the teachers used the technology. Students invited to participate in the study did not know that active learning technology would be used in their class until after they had enrolled and the semester began. Only students enrolled in courses in which teachers opted to participate in the study had access to the active learning technology.

This sample of convenience represents one possible threat to external validity. One additional threat to external validity is that a comparison population, who completed the pre- and post-semester engagement surveys but did not have access to the active learning technology, were taught different material by different teachers in different rooms. This is an offshoot from the same room and scheduling restrictions that led to the need to rely on a convenience sample. The university involved in this study does not schedule more than one section per semester of the same large lecture courses taught by the same instructor in the same room. As such, the comparison group could only be

drawn from courses of similar (though not identical) subject matter and ability level, and located in similar (though not identical) large lecture halls. Both of these limitations may curtail the generalizability of the findings.

The nature of the active learning technology itself may have had a detrimental effect on internal validity. It is possible that students who needed additional help or struggled with the course content gravitated toward using the technology more frequently than students for whom the course content was less challenging. This could lead to statistical regression as struggling students may have made greater use of the system and shown greater gains than confident students who self-selected to not use the technology. One purpose of the focus groups is to discern if such behaviors did indeed manifest themselves.

Another possible limitation is my own bias. In qualitative studies, it is valuable for the researcher to position himself or herself in the study by both identifying his or her experiences with the subject matter and assessing how those experiences could affect the research process (Creswell, 2013). This process gives the readers a full understanding of the context in which the qualitative data were collected and fosters a more complete understanding of the results. I have a background in teaching, having worked as a high school English teacher for 12 years, and work as an adjunct professor of instructional technology at a local small liberal arts college. My background in curriculum development and pedagogy and my knowledge of best practices in instructional technology may serve as both a benefit and a detriment to the research study detailed herein. Because I have a wealth of knowledge on the various pedagogical practices associated with the effective use of technology in education, I may have made

conclusions about the quality of the instruction that the participants in the study did not make. Left unchecked, such a situation could have led to moments in which my biases and interpretations of the practices implemented in the test courses drove the direction of the questioning. To mitigate against this, I attempted to bracket myself to the extent possible from the subject matter by adhering as much as possible during the focus group and interview sessions to a pre-written set of questions and a pre-determined list of activities. This practice served to prevent my biases from becoming apparent as the questioning and activities unfold.

One final limitation to this study is my assumption that the students responded honestly in the focus group sessions. It is possible that students felt pressure to overstate their perceptions of the technology, knowing that I, as a researcher, was looking to uncover the effectiveness of the system.

Summary

The use of lecture capture systems in higher education classrooms is on the rise, and the technologies associated with those systems are both ever-evolving and under-studied. The sequential explanatory mixed methods research that I conducted and document here was designed to measure how one such permutation of lecture capture technology – active learning technology – affects teachers' practices and students' engagement levels and grades. The remainder of this document entails a review of the literature (Chapter Two); a detailed description of the methodology I followed (Chapter Three); a discussion of the quantitative and qualitative data I collected (Chapters Four and Five); and a discussion section that includes my interpretations, suggestions, and recommendations for further study (Chapter Six).

CHAPTER 2: LITERATURE REVIEW

The Problems With Lecture

Pedagogical decisions are not made in a vacuum, as teachers weigh factors ranging from the subject matter, the size of the class, timing constraints, and even the physical layout of the classroom. Given these factors, traditional lecture classes became the norm in higher education, though they were often viewed as a necessary evil (Hensley and Oakley, 1998). There is no shortage of research on the effectiveness of lecture as an instructional practice, and while there are some mixed findings the generally accepted view is that lecture is rarely the best pedagogical strategy to increase students' engagement and retention of the course material.

In some cases studies have found lecture to be both appropriate and effective. Gibbs (1992) found that university teachers have often developed their own perspectives and theories based upon research they conducted in their areas of expertise. As a result, lecture offers the only way for students to gain access to that as-yet unpublished material (Gibbs, 1992). Similarly, Good and Brophy (2003) found that when professors invest the requisite time and effort in the preparation of their lectures, and when they emphasize high-quality delivery of the lecture content, lectures can be effective tools. They note, though, that the contexts in which lecture is an appropriate delivery method are limited (Good and Brophy, 2003).

Myriad studies illustrate the limitations of lecture's effectiveness. Studies show lecture is less effective than other practices for the development of higher-order thinking and problem solving skills, and the ability to apply new information to in additional contexts (Costin, 1972 and Mulryan-Kyne, 2010). Boschee (1990) found that this lack of

critical thinking and analysis was tied not to the content of the lectures, but to the mode in which that content was delivered.

> Lecturing implies that the teacher is a single, unquestionable authority. Although the content of the lecture may encourage a multiplistic, analytic approach to the world, the medium is an important part of the message. The lone voice of the instructor encourages students to avoid analysis and keeps alive the illusion of a simple, dualistic truth that can be memorized. The passivity of the instructional experience discourages students from exercising their own analytic skills. And at examination time or when a paper is due, students are expected to demonstrate skills that they have not been encouraged to exercise in the classroom. (Boschee, 1990)

Lecture can be detrimental to students' engagement, which can account for the poor track record lectures have in fostering higher-order thinking skills or lasting retention. Griffin found lecture to possess a "…lack of every possible prerequisite for effective teaching," which results in a shorter student attention span and a lower degree of students' retention of key concepts (Griffin, 2002). Further studies show that students' engagement levels dwindle as lectures progress. Students vacillate from attentive to non-attentive in ever-shortening cycles as lectures proceed, and only a change in instructional delivery can alter that cycle (Bunce, Flens, & Neiles, 2010).

Indeed, this understanding of the shortfalls of lecture has led to a surge in efforts to modify the course structure in large college classes. Knight and Wood found that integrating interactive practices in large biology courses yielded higher learning gains and conceptual understanding (Knight and Wood, 2005). Findings like theirs, coupled with a shift in the epistemological viewpoints of college instructors towards a broader embrace of constructivist practices (Piaget, 1972; Fensham, 2004; Hartle, Baviskar, & Smith, 2012), have led to a rethinking of how best to teach large-enrollment classes. One common change is to "flip" the instruction. Flipping a classroom involves inverting the

delivery of content such that knowledge transfer – the presentation of new material and concepts to students – is done out of class as homework, either through short videos, readings, or recorded mini-lectures. The in-class session is devoted to a variety of group-based activities including guided discussions, student-led demonstrations and evaluation of resources, timed search competitions, peer-led instruction, and unstructured work time (Maddison et al., 2014). This practice has been found to increase the amount of time available for learning activities without increasing the overall time dedicated to a class (Loo et al., 2016). Loo found that instructors are motivated to flip instruction as a means to increase students' engagement and to increase communication between teachers and students.

Students have positive perceptions of flipped classes, and as students are increasingly exposed to flipped class environments their opinions of those environments become more and more positive (Elliot, 2014). Perceptions aside, the findings on the effects of flipped instruction on learning outcomes are mixed. Elliot found that "flipped classroom experiments have had both positive and less-positive results" with regard to learning outcomes (Elliot, 2014). Lento found that in a college finance class a flipped environment led to higher grades on tests and lower dropout rates, and he found those benefits to apply to both high and low achieving students (Lento, 2016). Loo found that flipping a class does increase opportunities to engage with students and that it deepens information literacy instruction without increasing instructional time. Flipping a class requires greater effort on behalf of the teacher both in terms of preparation before class and in terms of actively facilitating communication in class (Loo, 2016).

The Importance of Students' Engagement

Efforts to flip college classes are rooted in a desire to deepen students' engagement in class (Maddison, 2014). There is no shortage of research surrounding student engagement on college campuses. Much of this research focuses on the overall level of engagement students have at an institutional level. The National Survey of Student Engagement (NSSE) is central to the understanding of undergraduate students' engagement. Its mission is to provide a picture of how students spend their time on campus, and to give institutions insights into the drivers of student success. (NSSE, 2015). The NSSE annual survey asks college freshmen and seniors about the degree to which they engage in a variety of academic and extra-curricular activities. The survey results are organized into four main themes: academic challenge, learning with peers, interaction between faculty and students, and campus environment. The 2015 survey revealed that students tend to be more motivated and engaged in courses that are more academically challenging, that interactions with faculty members are key drivers for engagement and career planning, and that financial stress negatively affects students' engagement on campus. While these results are instructive at the institutional level, they do little to reveal what specific factors, other than increasing rigor, can elevate engagement at the individual course level.

Much of the research produced surrounding student engagement builds on the NSSE findings, and seeks to answer questions about the entirety of the undergraduate experience. The NSSE is widely accepted as the standard measure of student engagement. Harper and Quaye (2015) cite Kuh, et al. to indicate the broad acceptance that NSSE has as it pertains to the academic value of student engagement:

> "Student engagement in the activities associated with each NSSE indicator is considered educationally purposeful, as it leads to deep levels of learning and the production of enduring and measurable gains and outcomes (Kuh et al., 2005)" (Harper and Quaye, 2015).

Zhao and Kuh (2004) used NSSE data to assess the degree to which student involvement in learning communities affects their overall engagement levels. Their central question built on the work of Chickering and Reisser (1993) and Cross (1998), focusing on the interaction between involvement in learning communities and students' academic performance. Using the NSSE data as their primary data source, Zhao and Kuh (2004) found that participation in learning communities throughout the undergraduate career led to higher levels of engagement and increased academic performance. Building off of the guidelines for online course delivery Chickering and Erhmann (1996) set forth, Robinson and Hullinger created a modified version of the NSSE survey to look specifically at engagement in online learning. Their findings indicate that students in online learning programs tend to exhibit higher levels of academic engagement then students in on-campus learning settings. Like other studies drawing from the NSSE dataset, this study did not look at drivers of engagement at the individual class level, nor did it lead to any specific pedagogical recommendations. Harper and Quaye (2015) also draw upon NSSE, and state that higher student engagement leads to increases in intellectual and cognitive skills, practical knowledge and transferability of skills, ethical development, psychological development, higher self-image, development in racial and gender identity, the accrual of social capital, and in persistence. Their work summarizes a decade's worth of research that relies on NSSE data to measure engagement across all walks of campus life.

While many studies investigating matters surrounding student engagement rely on NSSE data and focus primarily on institution-wide or program-wide engagement, some work looks more specifically at student engagement at the course level. Handelsman, Briggs, Sullivan, and Towler (2005) state that the NSSE is focused on student engagement at the "macro-level," and that it does not assess students' experiences in individual courses. In response, their work centered on "micro" level engagement; specifically, they focused their questions on the teaching behaviors could influence students' engagement in a class. To do so, finding no reliable and validated instruments that could measure course-level engagement, they developed the Student Course Engagement Questionnaire. This instrument allowed them to measure changes in student engagement levels within a single course such as what happens to engagement levels when a student fails a test or exam (Handelsman et al., 2005). Their first deployment of this instrument led them to find that course-level student engagement is comprised of four interwoven factors: skills, emotional engagement, participation, and performance.

Gasiewski, Eagan, Garcia, Hurtado, and Chang (2011) applied the SCEQ developed by Handelsman et al. to undergraduate science, technology, engineering, and mathematics (STEM) classes to measure the engagement levels of students in those courses. They note that active learning pedagogies drive science comprehension by allowing students to develop scientific habits of mind (Gasiewski et al., 2011). The authors found that when student perceive a course to be predominantly focused on lecture, engagement levels decline. Conversely, when students feel empowered to interact with their instructors and are comfortable asking questions in class, their engagement increases. Overall, they highlight a connection between student engagement levels and

the students' perception of the classroom climate and the degree to which the instructors provided feedback and a forum for open questioning. They find that instructor's behaviors are "just as important as those of their students in determining engagement" (Gasiewski et al., 2011). Their study highlights a significant interplay between student academic engagement, student perception of the class climate, and instructor practices.

Smith, Sheppard, Johnson, and Johnson (2005) also looked at classroom-level engagement in college courses, focusing on the interaction of project-based learning and cooperative projects on levels of student engagement. They find that an over-reliance on lecture in STEM courses tends to drive down engagement at the course level, and can lead to lower persistence among students. Their findings indicate that specific changes in teaching practices are linked to increased student engagement:

> One way to get students more actively involved is to structure cooperative interaction into classes, getting them to teach course material to one another and to dig below superficial levels of understanding of the material being taught. It is vital for students to have peer support and to be active learners, not only so that more of them learn the material at a deeper level, but also so that they get to know their classmates and build a sense of community with them. (Smith et al., 2005)

Other researchers also find that course-level engagement goes up when teachers make specific changes to their instructional practice. Umbach and Wawrzynski (2005) find that when faculty members use active and collaborative teaching techniques student engagement goes up, and overall grades improve as well. Ahlfeldt, Mehta, and Sellnow (2005) similarly note that when students are asked to participate in project-based learning in college courses, they report higher levels of participation and greater understanding of the course material.

Teachers and Instructional Technology

While epistemological shifts and pedagogical changes consistently drive greater engagement, the integration of technology as part of those pedagogical changes is not always linked with increases in student engagement or learning outcomes. There are three main barriers to the successful deployment of instructional technology to improve student engagement. The first is that often faculty members are slow to adopt new technology for their teaching. Salmon (2005) writes that academic staff members are reluctant to change. They often engage in teaching as a solitary act with little or no support from peers because there is generally little or no incentive for faculty members to innovate in teaching. Blin and Munro (2008) note that despite the promise of instructional technology to revolutionize education, teaching and learning on college campuses have yet to experience any significant technology-driven disruption. Technology is commonly used to support traditional modes of instruction rather than to transform the classroom experience for students (Blin and Munro, 2008).

A second problem with the role that technology can play in improving engagement is that once teachers do adopt new and potentially transformative technologies, sometimes the students simply do not use the technology as expected. Cole (2009) finds that though wiki technology is collaborative by design, integrating wikis into instruction did not yield improvements in engagement. Student perception of the technology limited its adoption, which in turn led to no measurable changes in engagement that could be attributed to the use of wikis (Cole, 2009).

Third, implementation of new technologies can have a profound effect on the teachers' mindset, which can in turn affect the teaching and learning experience. Adams

(2006) notes that the use of PowerPoint in teaching causes a change in the mindset of the teacher. The integration of a technology requires that the instructional content conform to the confines of that technology. In the case of PowerPoint, all presentations must be a linear presentation of images or bulleted text (Adams, 2006). Indeed as teachers become more accustomed to technologies, the very way that they think about the content that they teach changes (Parker, 2001).

Halverson (2003) notes that the implementation of new tools – and specifically new technologies – can create "webs of practices" in organizations. These shifts in normative behavior result in a refocusing of time and energy on learning to use the new tool and adjusting work so that it fits within the constraints of that tool (Halverson, 2003). Hora (2015) applied Halverson's systems-of-practice framework to education to study the effect that new tools and active learning procedures have on post-secondary classroom instruction. He finds that despite the rapid adoption of new technologies and the growing acceptance of constructivist pedagogies in post-secondary settings, there is still a heavy reliance on lecture in college science classes.

In those instances when active learning was used, it was done so predominantly with the use of classroom clicker technology, meaning that questions were posed to the class in a manner consistent with the limitations of the clicker systems (i.e. teachers posed multiple choice questions, students responded non-verbally, questions were posed in the midst of a PowerPoint lecture) (Hora, 2015). In this way, the parameters of the technology being deployed in the classroom dictate the nature of the constructivist activities that take place in the class, reshaping them in ways that are not always in keeping with instructional best practices (Vallance & Towndrow, 2007). Adams (2011)

argues that rather than thinking of digital media technologies as neutral agents in the classroom, they must be viewed as "evocative objects" designed to foster and support the use of new ways of knowing and thinking. As such, these instructional tools carry with them hidden curricula that require additional learning for both instructor and student. Instructional technology must be viewed as integral to the classroom culture, carrying "affective as well as effective implications for students and teachers alike" (Adams, 2011).

Lecture Capture Technology

As teachers look to improve engagement in large lecture classes, one common first step is to integrate technology into the lecture, often by using lecture capture systems to record the class sessions and redistribute it to the students online. Most formal research conducted to study or evaluate lecture capture systems focuses in some way on how student learning outcomes change as a result of the deployment of the lecture capture system. Stroup (2012), Cramer, Collins, Snider, & Fawcett, (2007); Dey, Burn, & Gerdes, (2009); Euzent , Martin, Moskal, & Moskal (2011); and Settle, Dettori, & Davidson (2011) used student grades in classes as the key metric. In most of these studies the researchers looked at the average grade across a course that used lecture capture and compared it to the average grade across a course taught by the same instructor and covering the same content without using lecture capture. The other primary means of measuring student performance was to monitor scores on standardized tests and measure the degree to which lecture capture deployment affected change in students' performance on those tests. Danielson, Preast, Bender, & Hassall, (2014); Whitley-Grassi, & Baizer (2010); Cascaval, Fogler, Abrams, & Durham (2008); Fernandes, Maley, & Cruickshank

(2008); Traphagan, Kucsera, & Kishi (2010); and Heilesen (2010) all employed this technique.

Lecture Capture and Learning Outcomes

The findings of the studies that focused on student learning are varied and, when taken as a whole, inconclusive. Traphagan et al. (2010) finds that lecture capture had little net effect on student scores on common tests. While Traphagan finds lecture capture does little to change the results on standardized tests, Danielson et al. (2014) find the opposite. They note that in certain instances (specifically in non-interactive classes that emphasize retention of new material) student learning outcomes do improve when lecture capture is deployed in the classroom. In certain classes, lecture capture has little to no value while in others, it does improve students' learning outcomes. The achievement levels of the students in the classes determine the disparity in these findings (Phillips 2011). Owston, Lupshenyuk, and Widerman (2011) find that higher achieving students access recorded lectures far less frequently than lower achieving students.

> Higher achievers bring to their studies well-developed and successful learning strategies. Therefore, lecture capture provides minimal added value for them if they attend class, take notes, or study the course content in other ways. Lower achievers are not as likely to have developed these successful strategies and depend more on viewing recordings multiple times in an attempt to make the subject matter sink in. (Owston, Lupshenyuck, and Widerman, 2011)

Karnad (2013) confirms these findings, stating that lower achieving students are more likely to access recorded lectures and are more likely to view those recordings in their entirety.

Stroup et al. (2012) assessed the degree to which lecture capture technology affects the ability of students to learn class material, finding that high GPA students

showed little change in their course performance, while students with low GPA performed slightly worse than expected in courses where lecture capture was deployed. Euzent et al. (2011) also looked at student performance as it relates to lecture capture use. Their findings indicate that the individual self-discipline and engagement of the students is directly tied to those students' success in classes using lecture capture. Key findings in the study indicate that courses with lecture capture deployed see a higher dropout rate than courses without lecture capture. Additionally, lecture capture is proven to be a viable course delivery option where space and finances limit the students' access to a physical classroom. Euzent et al. (2011) find that lecture capture seemed to have little effect on the students' actual performance in the class (when grades on common tests are used as a metric), but that more students drop out of courses that deploy lecture capture.

Student Perceptions of Lecture Capture

Students exhibit relatively uniform perceptions of lecture capture technology, though the specific circumstances of the technology's implementation in their class skewed those perceptions. Karnad (2013) find that students prefer classes that incorporate both lecture recordings and live lectures, and that students do not view recorded lectures as a replacement for attending live lectures. Schreiber et al. (2010) similarly note that students in medical classes prefer live lectures over recorded ones, and that viewing recorded content is less engaging than attending a class in person. Traphagan et al. (2009) also writes that students prefer live lecture to recorded viewings, those students generally perceived the technology to be positive.

Indeed, almost all studies, including those by Taplin, Low, & Brown (2011), Cramer et al. (2007), Nicholson and Nicholson (2010), and Woo et al. (2008) show that

student perceptions of lecture capture systems are positive. Students' highly favorable views of lecture capture are not in line with actual student performance – that is, students rated lecture capture systems highly whether or not the systems actually contributed to an increase in learning in the class (Euzent et al. 2011 and Heilesen 2010).

Taplin et al. (2011) provide probably the most comprehensive analysis of student perceptions of lecture capture. They find that students overwhelmingly praised the idea of lecture capture. Their findings indicate, however, that overall use of the lecture capture systems was low, and that students ascribed a low monetary value to lecture capture technology. Students valued lecture capture at an average rate of only $15 per semester - this data seems to contradict the high praise most students gave to the notion of lecture capture when surveyed. Woo et al. (2008) find similarly positive responses to lecture capture from students, though teachers had less favorable perceptions of the system. Danielson et al. (2014), too, state that instructors are less optimistic about lecture capture than students – they worry that it will negatively affect attendance, and that it will be under-used by the students.

Student Behaviors With Lecture Capture

Just as there is much uniformity in students' perceptions of lecture capture technology, their uses of the systems are often in alignment. Soong et al. (2006) and Traphagan et al. (2009) find that students mainly use recorded lectures to make up for missed lectures and to prepare for assessments. Phillips (2010) finds that use of the system is high early in the semester, but wanes as the course unfolds. Prior to exams, though, system use spikes again indicating a preference to use the recorded lectures as a means to prepare for exams (Phillips, 2010).

Another key behavior that changes when lecture capture is implemented in a class is student attendance, and on this point there is less uniformity in the published findings. Woo et al. (2008) find that instructors tended to think that students would abuse the technology to skip class, and that doing so would detrimental to their learning, even if those students had access to the recorded lecture. Gosper (2008) finds those concerns may be warranted, noting that students, too, state that the presence of a lecture capture system could serve as a motivation to miss class. Drouin (2014) notes that students in a large psychology class were more likely to miss class when they knew the lecture would be recorded, and those absences correlated to lower final grades in the course. Traphagan et al. (2010) state, too, that lecture capture lowers the rate of attendance. Unlike Drouin (2014), though, Traphagan et al. (2010) find that using the recoded lectures in lieu of attendance nullifies the effects of absenteeism on student performance. Other though, such as Von Konsky et al. 2009; Holbrook & Dupont, 2009; and Pursel & Fang, 2012, indicate access to recorded lectures has little to no effect on student attendance at live lectures.

Teacher Behaviors With Lecture Capture

The area of lecture capture that is least studied centers on teacher's behaviors. Danielson et al. (2014) find that teachers were more likely to encourage students to use the captured lectures when the students were enrolled in higher-level or graduate courses. Additionally, if teachers knew that the content would be posted online for future reference outside of the specific context of the class, they were more like to repeat themselves, re-explain topics, and reiterate ideas. Danielson et al. address instructor

practice, but do little to explain why instructors change their teaching behaviors when lecture capture is present. Overall there is a lack of clarity on this matter.

Lecture Capture in Flipped Classrooms: Technology Enhanced Active Learning

When lecture capture technology is used in conjunction with student response systems and other technology-based discussion tools, the combined tool is termed an *active learning tool*. Active learning technologies allow instructors to upload lecture slides (typically in the form of PowerPoint slides) into the system prior to class. Instructors can embed quizzes, polls, and other classroom response prompts into the slides, making these active learning systems a more robust and visually oriented iteration of the more widely-used classroom response or clicker systems. As class unfolds, students have access to the enhanced slides on their laptops or mobile devices. They can use the system to respond to questions, polls, and surveys. Additionally, digital note-taking, questioning, and discussion tools allow students to interact with the slide content, with their classmates, and with the instructor as the course unfolds. They can flag certain slides or points in the lecture as confusing, mark areas that they know they will need to re-visit, and respond to questions posted by other students. Once the class is over and the captured video is processed, it is automatically fed into the active learning system, and the student notes and comments are synced to the recording. Instructors have access to data dashboards that reveal levels of student use of the system, frequency of interactions, and accuracy of response to quiz questions.

Such tools are in use in over 1,000 institutions worldwide, but their use is sporadic, often limited to a single course at any given institution (Kolowich, 2012). A 2014 study shows that there is a positive correlation between students correctly

answering in-class questions using an active learning system and the average grade on exams (Sampson, 2014). These data are perhaps not surprising, but they do point to the value that active learning systems have as data generation engines that can be used to measure student engagement. Because active learning technology is so new, there is no existing research on the overall effectiveness of active learning systems, nor is there clear data on the student and instructor perceptions of these systems.

Technology Enhanced Active Learning Spaces and Initiatives

Marrying technology (including but not limited to active learning technology) with physical and pedagogical changes to the classroom lead to learning spaces termed active learning classrooms (ALCs) or initiatives called technology enhanced active learning (TEAL) programs. Ge, Yang, & Wolfe (2015) find that there is a high degree of variance in the extent to which teachers integrate technology into active learning classrooms. This variance may in part be rooted in the scope of changes needed to adapt a class to an active learning space.

> The use of ALC technology requires a fundamental paradigm shift on the part of the instructors, which includes a new way of viewing and thinking about knowledge, learning, and instruction. In addition, it is necessary to provide extensive examples and trainings to instructors on two dimensions (technological and pedagogical) and to help them reconceptualise learning and instruction. (Ge, Yang, & Wolfe, 2015)

Hu & McLaughlin (2010) and McCoy et al. (2015) find that technology enhanced active learning initiatives are gaining in popularity in medical schools because instructors are responding to the tech savvy nature of the students entering their programs. “The current generation of students requires interactive, technology-enhanced learning approaches that support a variety of learning styles and modalities” (McCoy et al., 2015).

While it is certainly true that today's students have a more technologically focused worldview Dahlstrom & Dziuban (2013) note that such a mindset does not necessarily translate to proper use of technology in active learning settings. They state that students are immersed in technology and have generally favorable attitudes toward it, but "technology has only a moderate influence on students' active involvement in particular courses or as a connector with other students and faculty" (Dahlstrom & Dziuban, 2013). To that point, Hu & McLaughlin (2010) find that integration of technology into a TEAL classroom must be intellectually stimulating, innovative in creating a collaborative ethos, and clearly tied to the learning objectives in order for it to meaningfully increase students' engagement or learning outcomes. When those pieces are in place, Dori & Belcher (2006) find that TEAL projects can be highly effective.

> TEAL projects foster individual and group thinking, supported by hands-on activities, visualizations, and small and large group discussions for knowledge building. Aiming at enhancing conceptual understanding of mechanics and electromagnetism phenomena, these two projects are designed to actively engage students in the learning process, using technology-enabled methods as appropriate. (Dori & Belcher, 2006).

Wolfe & Chan (2016) find that providing a flipped classroom model using the Echo360 active learning platform (ALP) is effective at facilitating the flipped design, but they have no significant findings as to the effects of the technology on student behaviors or outcomes. They find that ALP use was tied to perceived ease of use and perceived usefulness.

> The Flipped Classroom concept requires students to contribute extra time for viewing the video lectures prior to coming to class. Statistics as to how many students have viewed the online lectures have eased these doubts only to a certain extent. Our findings seem to confirm the generally perceived advantages of Flipped Classrooms. (Wolfe & Chan, 2016).

Gaps in the Literature and Areas for Continued Study

On the whole, the existing research on the effects of lecture capture and related technologies on pedagogy and learning fails to paint a clear picture of the effectiveness of the system. Specifically, the addition of active learning technology into the realm of lecture capture is an area that has remained largely un-studied. Some studies indicate a growth in student learning while others indicate opposite. Student perception of these systems is mostly glowing, but student test data and showed no statistically significant change. No studies have focused specifically on active learning technology's effects on student engagement. Because there is so little published research on the specific changes in instructor practice tied to the deployment of these technologies, this area seems to be one in which there is clearly room for further study. This gap in the research may indicate that until recently very little thought has been given to the teacher's role in the proper use of active learning technology – it has been viewed as a student-centric system. Another area that is significantly under-represented is the study of how individual students' behaviors change as a result of these systems being implemented. All studies, with the sole exception of the work done by Stroup et al. (2012) look at aggregate student test scores or grades to make general statements about the effectiveness of lecture capture. Studies that break out individual student engagement and measure changes therein might better uncover those specific circumstances in which this technology is effective. These gaps and inconsistencies in the literature indicate that there is much room for further research in this field.

Most studies looking into lecture capture rely heavily on quantitative methodologies. Those studies that employ a mixed methods approach, though, have a broader scope and

often are able to draw deeper conclusions by putting quantitative findings into context. With that knowledge, further study of lecture capture should employ a mixed-methods approach to ensure that students' and instructors' perspectives and opinions can provide a context for system usage or statistics and changes in student engagement or grade data. Moreover, Gasiewski et al. (2011) note that there is little published research on active learning pedagogy, and what studies have been done are primarily focused on quantitative questions.

A final analysis of the existing research on lecture capture and related active learning technologies indicates that there are no clear answers when it comes to measuring a technology such as this, and there is room for further study in this area. Future research should address questions such as: What practices result in the most effective use of lecture capture with active learning technology? What is the degree to which active learning technology effects engagement and learning outcomes? What are the contexts in which students choose to use these technologies? What are the specific instructional behaviors that students say compel them to use the tools? Answers to these questions could ultimately lead to improvements in student engagement and learning outcomes, by informing a more meaning implementation of active learning technology that marries the product with best pedagogical practices.

CHAPTER 3: METHODOLOGY

Context

Little to no published information exists concerning the effects active learning technology has on student engagement in class. This sequential explanatory mixed methods study measures how and why an active learning system affects student engagement and student and instructor practices. It uncovers what motivates students to use (or choose not to use) active learning technology and it details their perceptions of the technology. The study reveals differences in perception that exist between students who choose to use active learning technology and those who do not. The study also identifies themes in the instructor experience surrounding the use of active learning technology, and uncovers how these pedagogical changes can drive student use of the technology. It identifies ways in which the implementation active learning systems causes teachers to change their pedagogical practices or causes changes in the way that teachers think about their instructional content.

These findings will provide a richer understanding of the ramifications of the implementation of active learning technologies. This will in turn inform any training decisions that surround such an implementation, and allow institutions to make informed decisions about how to encourage instructors to make pedagogically sound use of the technology.

Research Questions

This study addresses two primary research questions, both with underlying sub-questions.

1. How do instructors implement active learning technology?
    a. How do instructors change their practices when the technology is available?
    b. How do instructors perceive active learning technology and its utilization in their classes?
    c. How does using the technology change teachers' thinking about their own instruction?
2. How do various implementations of active learning technology affect student engagement and learning outcomes?
    a. How do students' engagement levels and exam grades correlate with different uses of active learning technology?
    b. How do students' behaviors in and out of class change when active learning technology is implemented in their classes?
        i. Why do students choose to utilize (or not utilize) the features of active learning technology?
        ii. How do specific pedagogical implementations of active learning technology affect students' use of and perceptions of the technology?
        iii. How do specific pedagogical implementations of active learning technology change students' thinking about their own learning?

Overall Research Design

Because of the nature of the research questions, a mixed methods sequential explanatory research design that emphasizes the qualitative data is best suited for this study. Two distinct phases comprise this mixed methods sequential explanatory design: a quantitative phase followed by a qualitative phase (Creswell, Plano Clark, et al., 203). Using this design, I first collected and analyzed the quantitative data pertaining to student demographics, students' declared majors and minors, students' cumulative grade point averages, students' use of the active learning technology, students' grades, and students' engagement levels. Then I collected and analyzed qualitative data pertaining to

instructors' statements about their implementation of the technology. This data helped explain, or elaborate on, the quantitative results obtained in the first phase, and informed the creation of cases for the second phase in which I collected qualitative data about students' experiences with the active learning technology, students' perceptions of that technology, and students stories about how their teachers used the technology.

The second, qualitative phase built on the first, quantitative phase. The rationale for this two-phase approach is that the quantitative data (and the qualitative data collected from the instructor interviews), and their subsequent analysis, provided a general understanding of the effects of active learning technology on student engagement. The second phase's qualitative data, and their subsequent analysis, contextualized and explained those phase one results by exploring participants' views in more depth (Creswell, 2003; Rossman & Wilson, 1985; Tashakkori & Teddlie, 1998; Creswell & Plano Clark, 2011). This study concerns itself less with the actual change in student engagement (though that is a significant element in the sampling approach for the study's focus groups), and more with how and why students used the active learning system, what their experiences were when they did use it, and how instructors implemented the technology in their teaching. In that light, the priority (Creswell, 2003) of the study is on the qualitative findings, because they focus on in-depth explanations of the data collected in the first, quantitative phase. I connected the quantitative and qualitative phases, using quantitative findings to inform selection for the phase two focus groups, and to inform the refinement of the interview protocol for the qualitative portion of phase one (Ivankova & Stick, 2007).

The core theoretical framework underpinning this study is that the use of the

independent variable (the active learning technology) will have a positive correlation with the dependent variables (student learning outcomes and engagement). As I analyzed the resulting data, I needed to account for the moderating variable of the practices of the participant instructors. Figure 1 illustrates the sequence of events in this mixed-methods study.

Phase	Procedure	Product
Sampling	·Invitation ·Instructor Training ·Informed Consent	·Quantitative data on seven test classrooms and ten comparison classrooms
Quantitative Data Collection	·Echo360 data collected ·LMS grade data ·SCEQ data	·Data reports converted into spreadsheets
Quantitative Data Analysis 1	·Descriptive analyses ·Two-level analyses	·Descriptive statistics and two-level analyses
Qualitative Data Collection 1	·Instructor interviews ·Transcribing ·Coding	·Transcripts, notes, memos
Qualitative Data Analysis 1	·Themeatic analysis ·Cross validation of findings	·Coded transcripts and themes
Connecting Phase One Quantitative and Qualitative Data	·Forming student cases	·Student focus groups
Quantitative Data Analysis 2	·Descriptive analyses ·Multiple regressions	·Desriptive and regression statistics
Qualitative Data Collection 2	·Student focus groups ·Transcribing ·Coding	·Transcripts, notes, memos
Qualitative Data Analysis 2	·Themeatic analysis ·Cross validation of findings	·Coded transcripts and themes
Integration of Phase Two Quantitative and Qualitative Results	·Qualitative themes provide context to quantitative data	·Discussion and conclusions

Figure 1: Chronological progression of mixed methods design (modified from Ivankova et al. 2006 and Gasiewski et al. 2011)

Figure 2 illustrates the study's conceptual framework.

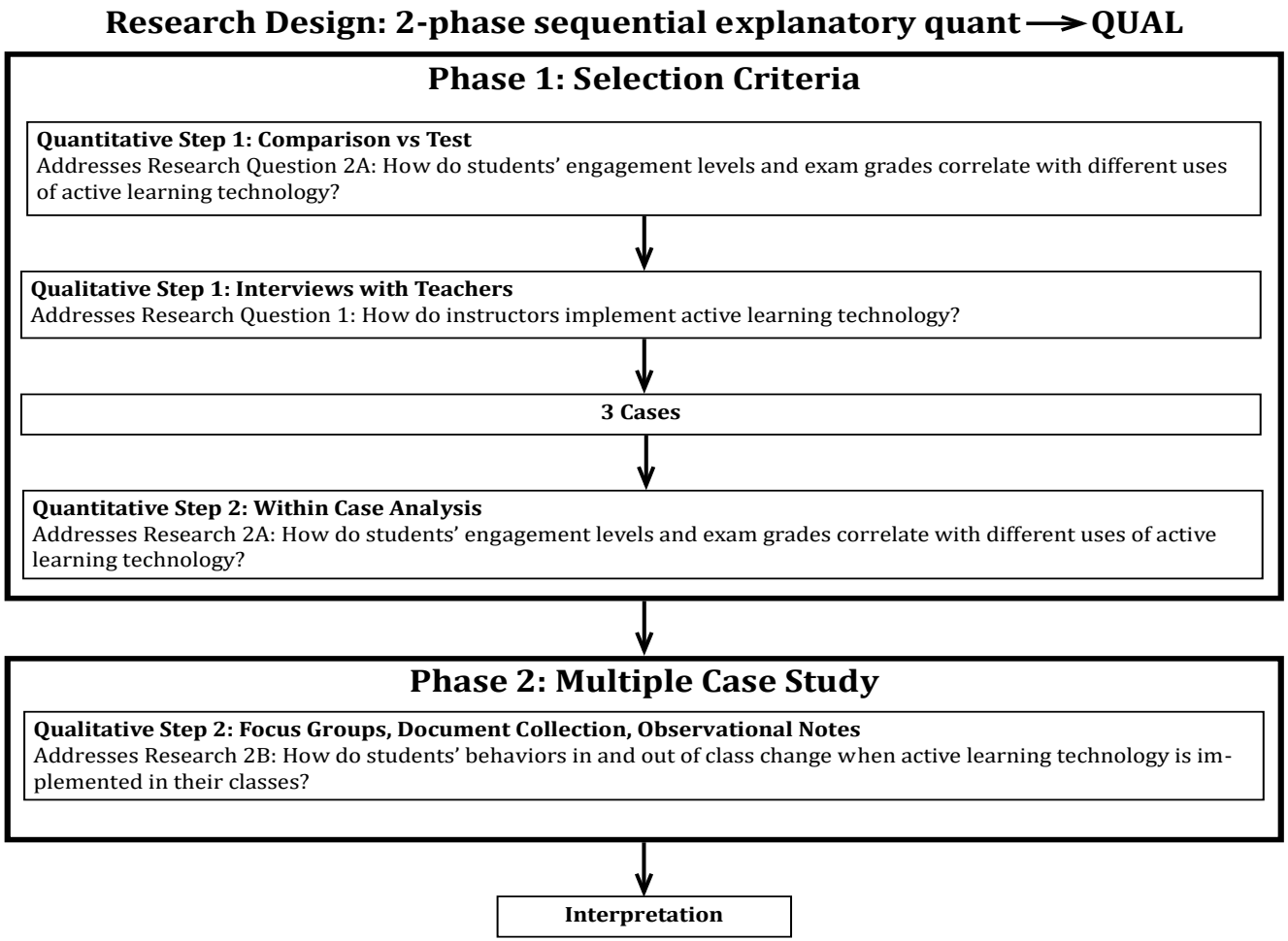

Figure 2: Conceptual framework of mixed methods design

This study draws upon the work of many authors (Carini, Kuh, and Klein, 2006; Hughes & Kwok, 2007; Finn & Rock, 1997; Finn, 1993; Skinner, Wellborn, & Connell, 1990) who have previously described the correlation between student engagement and increased student learning outcomes. Through it, I measured student engagement levels at both the beginning and end of the semester in both the test courses and the comparison courses in order to test my expectation that students who are encouraged to use the active learning technology regularly by their instructors, and who subsequently choose to do so, will register increased levels of engagement across multiple factors and increased final grades.

Setting and Technology Deployment

The study took place on the main campus of a large research university in the American Midwest. Prior to the beginning of this study, the university installed a lecture capture system equipped with active learning technology in five of the largest lecture halls on the campus that school. The technology installed was an advanced lecture capture system called the Echo360 Active Learning Platform (ALP). Echo360 allows instructors to capture high-quality videos of their lectures and presentation materials and make those videos available to students. The system also allows for instructors to include interactive slides in their presentations, allowing for student feedback during the lecture. Additionally, students can post discussion questions, notes, and bookmarks within the presentation as it unfolds or as they view it after the class ends. The lecture recordings, or captures, are fully automated and pre-scheduled;

they initiate automatically and feed into the course's learning management site automatically, requiring no input from the instructor.

The Echo360 system integrates with the Blackboard and Canvas Learning Management Systems, and allows students to view lectures online via any computer or mobile device. The configuration in the five rooms listed above captures instructor audio, all materials presented using the in-room PC, and (optionally) HD video from a dedicated video camera. Additional inputs such as a document camera or second video source can also be captured. The configuration in these rooms also allows for optional live web streaming of the course. The instructor can pre-schedule recordings or manually initiate them. Generally, instructors simply turn on their microphone and begin teaching normally, and the system automatically records the class session. Once class is complete, the recording is sent to the cloud-based server for processing. Processing times vary, but usually within a few hours the video is made available for viewing. Echo360 also provides a desktop capture system, allowing instructors to capture short videos from their own PC or laptop. These videos are made available for playback in the same Blackboard or Canvas interface as the lecture capture videos. Additionally, instructors can upload their own pre-existing media content to the Echo360 cloud server and distribute it to their classes.

Instructors can use the Blackboard or Canvas integration to track student views, analyze what portions of lectures are most heavily viewed, and even engage in discussions with students about the captured material. The system can generate a variety of reports, with a wide array of data points. Whole-class level reports detail overall view-rates for videos (i.e. the number of students who viewed a video and the average amount

of the videos that students viewed), which videos generated the most interactions (such as questions posed, discussions generated, and sections tagged for bookmarking), and overall use-rates of the PowerPoints that are uploaded into the system. On the individual student level, reports detail how many videos each student viewed, the percentage of the video that they viewed, number of interactions (such as questions posed, discussions generated, and sections tagged for bookmarking) each student had with each video, and the number of interactions each student had with each uploaded PowerPoint. The Blackboard and Canvas grade centers provide reports specific to student grades, including mean grades on individual tests and assignments, mean final course grades, individual grades on tests and assignments, individual final grades, and cumulative click rates on specific course material. I used all of these data points, in combination with data collected from the pre-semester and post-semester surveys, to reach preliminary findings about the effects of Echo360 on student learning outcomes, and I used the data to inform the formation of the student focus groups.

Sampling

The limitations of classroom scheduling, technology hardware installation, and teaching assignments required that I rely on a convenience sample for this study. I could not control which classrooms the university selected for Echo360 installation, as the technical requirements of the system necessitated that particular hardware configurations be present in the classrooms in which the system was installed. Of the rooms ultimately selected, the largest has a capacity of 294 seats and the smallest has a capacity of 150 seats. The rooms hold courses that represent a large cross section of the university's colleges and majors. I contacted all professors scheduled to teach in these five rooms, and

informed them, via a letter of invitation, of the installation of the active learning technology. Representatives from the Echo360 company and I trained the instructors who indicated interest in using the technology. The letter indicated that should the instructors choose to use the technology, they would be invited to participate in the research study. The teachers who responded to the invitation and decided to use the technology in their teaching represented a wide array of colleges, and taught classes of varying levels in a wide range of subject areas. I had no control over what types of classes were taught, what level of courses used the technology, or the way in which the teachers used the technology. Students invited to participate in the study did not know that active learning technology would be used in their class until after they had enrolled and the semester began. Only students enrolled in courses in which teachers opted to participate in the study had access to the active learning technology. This sample of convenience represents a possible threat to external validity.

Once the semester began, I visited each of the classes involved in the study, invited the students to use the lecture capture system, and distributed an informed consent document (see appendix A) detailing the research study. I indicated to the students that they were free to use the lecture capture system without participating in the study. I informed them that if they chose to participate in the study they would be asked to complete two questionnaires and may be asked to participate in focus groups and/or interviews after the conclusion of the semester. I also told them that they could withdraw from participation in the study at any point, and that doing so would not reduce their access to the lecture capture system.

To add to the validity of the proposed study, and to allow for more robust statements about the effectiveness of the active learning technology, I also recruited a second set of instructors to serve as part of a comparison group. Again, due to classroom scheduling procedures and course assignments, I used a convenience sample to comprise the comparison group. I sent an additional invitation letter to all instructors teaching in five similarly-sized large general purpose lecture halls in which the active learning technology was not installed. I invited these instructors to participate in the study as part of the comparison group. The only requirements of this comparison group were that the students in these classes complete the pre- and post-engagement instruments and that the instructors allow me to compile students' grade data at the close of the semester. This comparison group allowed me to make more meaningful claims about the results gleaned from the test classes, as I was able to compare student engagement levels between technology-enabled classes and classes with no access to the technology. I was able to use this comparison data in my composition and implementation of the instructor interview protocol.

The comparison group was made up of courses that were taught in similar classrooms and covered similar subject areas as the test group. Both groups have courses from the life sciences, physical sciences, and social sciences. It was not possible at the university at which this study took place to build a control group for this study. Instructors generally do not teach more than one large lecture course per semester, and generally only one section of each large lecture course is offered each semester. As such, it was not possible to measure behaviors in two classes taught by the same instructor, in which one used active learning technology and one did not. It was also not possible to

measure two classes covering the exact same content, in which one used active learning technology and one did not. Such control groups would have allowed me to make pointed claims about the causes the active learning technology had on students' learning outcomes and engagement. Absent such control groups, a comparison group (with instructors of similar backgrounds teaching courses of similar subject areas to students of similar ability levels) afforded me the best possible scenario for making statements of correlation surrounding the use of active learning technology and changes in learning outcomes and engagement.

After the semester concluded, I compiled students' grade data, students' demographic data, students' engagement data, and students' lecture capture use data. Using those data points, I identified individuals who fell into three distinct bounded groups: students who used the system heavily and showed a high level of engagement (the highly engaged/heavy users), those who made moderate use of the system and showed a moderate level of engagement (the moderately engaged/moderate users), and those who infrequently used the system and showed low levels of engagement (the lightly engaged/light users). Once I identified the students in those populations, I invited them to participate in a focus group concerning lecture capture technology.

Table four details the courses involved in this study. The group of test courses was comprised entirely of undergraduate courses: three entry-level life sciences courses, one entry-level computer science course, one intermediate-level biology course, one intermediate-level electrical engineering course, and one upper-level finance course. The comparison group was also made up of undergraduate courses taught in large lecture halls by full-time faculty members. The comparison group consisted of five entry-level

chemistry courses, one entry-level geography course, one entry-level philosophy course, two intermediate level psychology courses, and one upper-level sociology course.

Group	Subject Area	Level	Enrollment
Test	Life Science	100-level	220
Test	Life Science	100-level	235
Test	Life Science	100-level	267
Test	Computer Science	100-level	110
Test	Biology	200-level	254
Test	Electrical Engineering	200-level	153
Test	Finance	300-level	187
Comparison	Chemistry	100-level	196
Comparison	Chemistry	100-level	185
Comparison	Chemistry	100-level	190
Comparison	Chemistry	100-level	205
Comparison	Chemistry	100-level	203
Comparison	Geography	100-level	180
Comparison	Philosophy	100-level	147
Comparison	Psychology	200-level	133
Comparison	Psychology	200-level	128
Comparison	Sociology	300-level	57

Table 4: Courses and ability levels by group

An a priori power analysis for a MANCOVA with two groups and a small effect size suggested a total sample size of 199 to achieve a Power of .8. Seven instructors agreed to participate in the study, exposing about 1,500 students to the technology. At a minimum, my design for the study required that at least two different instructors participate; exposing roughly 400 total students the system. My sample of 1,500 exceeded the minimum requirement the power analysis suggested.

Phase One: Quantitative and Qualitative Data Collection

Quantitative Data Collection and Instrumentation

For the first quantitative phase I collected data in three key ways. I identified two populations to allow for a match-comparison study: classes in which the active learning technology was deployed and integrated into instruction, and comparison classes in which the technology was not deployed. The classes in both the test population and the comparison population represented diverse areas of study, levels of difficulty, and had similar learning objectives. I distributed an on-line survey to all students in both the test group and the comparison group twice: once at the beginning (see appendices B and C) of the semester and once at the end (see appendices D and E); I used these surveys to collect basic demographic data about students in both groups, course engagement data about students in both groups, and usage data and students' perceptions of the Active Learning Platform from students in the test group. The Student Course Engagement Questionnaire (Handelsman, M. M., Briggs, W. L., Sullivan, N., & Towler, A., 2005) served as the data collection mechanism for students' engagement levels.

The Student Course Engagement Questionnaire (SCEQ) measures overall student engagement in a class across four distinct factors of student engagement: skills engagement, participation/interaction engagement, emotional engagement, and performance engagement. Fredericks et al. (2004) established that engagement is composed of three primary elements: behavioral, cognitive, and emotional. In developing the SCEQ, Handelsman, Briggs, Sullivan, and Towler operationalized course-level engagement, defining it as an interaction with course material both in and out of class (Gasiewski et al., 2011). They administered the instrument to 266 undergraduates at the

University of Colorado at Denver to validate it and conduct a factor analysis. The instrument asks respondents to rate their degree of agreement (scale: 1=not at all agree; 6=strongly agree) on questions of general engagement and questions targeted toward four specific engagement factors. Table five shows the descriptive statistics for the SCEQ.

Correlations, Descriptives, and Reliabilities of Student Engagement Factors in the SCEQ

Factor	Mean	SD	Skills	Emotional	Part/Int	Performance
Skills	3.70	.66	(.82)			
Emotional	3.53	.80	.44	(.82)		
Participation	3.06	.84	.26	.34	(.79)	
Performance	4.06	.69	.36	.25	.23	(.76)

Note: Part/Int = participation/interaction. Coefficient alphas are displayed diagonally in parentheses. All coefficients are statistically significant at $p < .01$.
Source: Mitchell M. Handelsman , William L. Briggs , Nora Sullivan & Annette Towler (2005) A Measure of College Student Course Engagement, The Journal of Educational Research, 98:3, 184-192.

Table 5: Correlations, Descriptives, and Reliabilities of Student Engagement Factors

A factor analysis of the SCEQ shows that the skills factor accounts for 13.91 percent of the variance, the emotional factor accounts for 10.20 percent of the variance, the participation/interaction factor accounts for 9.68 percent of the variance, and the performance factor accounts for 8.90 percent of the variance (Handelsman, Briggs, Sullivan, & Towler, 2006). The use of this questionnaire facilitated the collection of data pertaining to student engagement in class, and the degree to which students self-report a change in their engagement over the course of a semester. The SCEQ and its scoring mechanism are shown in appendix B.

I collected additional quantitative data, including student-specific use rates of the active learning technology and students' grades on exams and finals, and students' final

grades in the course. In addition to the questions of the SCEQ, I surveyed all participant students and gathered the data points detailed in table six from every respondent in both the test and comparison groups.

Data Point	Response type
Name	Open Response
Sex	Multiple Choice
Age	Numeric Selector
Major	Open Response
Minor	Open Response
Is this course required for your major or minor?	Multiple Choice
How often did you miss this class?	Numeric Selector

Table 6: Non-SCEQ data points collected on student surveys

First Quantitative Phase Data Analysis

After the semester, I analyzed all this data using statistical analysis software to conduct a two-level analysis. I began the analysis by first exploring the relationship between the comparison group and the test group. That exploration centered on identifying any significant correlations between two dependent variables—students' final class grades, and students' engagement levels— and six predictors. I used the SAS statistical analysis program to conduct a two-level analysis to assess how those two independent variables were affected by active learning technology use, students' grade point average, and whether or not the course was required for degree completion. I detail the results of these findings in chapter four.

These analyses addressed the research question "How does active learning technology affect student engagement?" and the sub question "Does increased use of the technology correlate to higher grades in class?" I used the sum of each students' total number of video views as a non-continuous variable because doing so allowed me to group students into broad categories related to their use of the system. This facilitated the composition of the interview protocol as well as the formation of the bounded cases. Ultimately this allowed me to gather qualitative data from groups of students who had similar interactions with the system, thereby affording me a picture of the trends and themes that arose pertaining to student perception of the system.

The validity of this quantitative portion of the study hinges on the SCEQ validity information (Handelsman et al., 2015). Their work indicates that all four factors measured by the SCEQ's four subscales all have reliabilities that fall within the recommended level. They reported evidence of discriminant and convergent validity of the SCEQ. Multiple regression analyses of the SCEQ indicate the degrees to which the four factors contribute to homework grades, exam grades, and overall course grades (Handelsman et al., 2005).

Phase One Qualitative Data Collection: Instructor Interviews

I used the data gathered during this first quantitative phase to serve as the basis for the first qualitative portion, which consisted of the instructor interviews. Once I completed the first phase of the quantitative analysis, I contacted all seven teachers from the test courses and asked to interview them. I provided them with the interview questions (see appendix C) in advance of the scheduled interview. The interviews took place either in person or over the phone. I recorded each one, and used those recordings

to generate transcripts. This is the first point at which the qualitative portion of my data mixed with my quantitative data. I designed the interview questions to address research question one:

1. How do instructors implement active learning technology?
    a. How do instructors change their practices when the technology is available?
    b. How do instructors perceive active learning technology and its utilization in their classes?
    c. How does using the technology change teachers' thinking about their own instruction?

In the course of those interviews I shared with the instructors the quantitative findings from the first phase of the study. I transcribed and coded these interviews; by searching for repeated words related to instructional practices, perceptions of the active learning platform (ALP), and thoughts about instruction I ultimately identified a series of themes. I detail the findings of these interviews in chapter four, and discuss their significance in chapter six. In short, the interviews revealed significant themes surrounding the nature of the instructional practices in the test courses, and the degree to which the instructors advocated for the use of the active learning technology.

Phase One Quantitative Data Collection, Step Two: Within-Course Analysis

My analysis of the qualitative data generated by these interviews lead to additional analyses that looked specifically at the Echo360 ALP-enabled courses. Again controlling for student GPA, pre-course engagement, and whether or not the course is required, in this secondary analysis I analyzed any differences in engagement and/or grades between courses that used Echo360. This analysis, detailed in chapter four, uncovered differences between classes that stemmed from specific instructor practices and, in conjunction with the instructor interviews, allowed me to illuminate the degree to

which instructor practice effected the manner in which students interact with the active learning technology.

Phase Two: Qualitative Data Collection

The quantitative findings coupled with the data stemming from the instructor interviews (which I will detail in Chapter 4) provided a picture of what happens when active learning technology is installed in a classroom and used in various ways. These findings answered all of research question 1 (How do Instructors implement active learning technology?), as well as research question 2a (How do students' engagement levels and exam grades correlate with different uses of active learning technology?). However, these findings offered no context; specifically, they did not describe the learning behaviors surrounding the use of ALP. Such context would provide answers to the remainder of my research questions:

1. How do instructors implement active learning technology?
    a. How do instructors change their practices when the technology is available?
    b. How do instructors perceive active learning technology and its utilization in their classes?
    c. How does using the technology change teachers' thinking about their own instruction?
2. How do various implementations of active learning technology affect student engagement and learning outcomes?
    a. How do students' engagement levels and exam grades correlate with different uses of active learning technology?
    b. How do students' behaviors in and out of class change when active learning technology is implemented in their classes?
        i. Why do students choose to utilize (or not utilize) the features of active learning technology?
        ii. How do specific pedagogical implementations of active learning technology affect students' use of and perceptions of the technology?
        iii. How do specific pedagogical implementations of active learning technology change students' thinking about their own learning?

Answers to these questions are the core of this research, because a full understanding of the conditions that drive high use of active learning technology will ultimately inform the creation of a framework for the proper implementation of the technology. All of these questions require the use of qualitative data collection techniques in order to allow the students who had access to the technology to tell the stories about how and why they used it (or chose not to). To that end, I followed the quant ➔ QUAL sequential explanatory multiple-case mixed methods design and used the quantitative data to inform the formation of multiple bounded cases for the second, qualitative phase. The quantitative data and instructor interviews together served as the selection criteria for the cases in the qualitative phase of this study, by revealing that three distinct, bounded cases existed among the classes that used ALP.

This second phase, which relied on the collection of qualitative data from those three cases, focused on the students, and addressed research question 2b (and its sub questions). Of the five typologies of qualitative research, the research questions driving this portion of the study required that I implement a case study approach. A grounded theory approach does not apply, as there is no attempt in this study to generate or discover a broader theory (Corbin and Strauss, 2007). As the study is concerned with a mixed population rather than a single individual, the narrative approach would not fully address the research questions (Creswell, 2013). An ethnographic approach could address some of the learning experiences the students had. Such a study would ultimately ask questions concerning the culture of the classroom in which the technology was deployed, the manner in which the individuals in the class interacted with one another, and the shared patterns of the course as a whole (Wolcott, 2008). Those questions are too broad

in nature to adequately address the research goals of this study. A phenomenological approach would uncover the core essence of the experience of the students who used lecture capture technology; it would describe in detail what the act of using the technology was like, but it would not necessarily answer why students used it. Yin (2014) states that case study should be employed when the research question focuses on the "how" and "why" of a contemporary problem in which the researcher has little or no control over the behavior of the participants. Therefore, the case study approach – more specific than an ethnography, broader in scope than a narrative, less concerned with theoretical development than grounded theory, and more focused on motivation than phenomenology – was the proper methodology in this instance.

The study relied on the multiple case study model, as I was seeking to clarify the differences between three distinct, bounded cases (Creswell, 2013). Patton (1990) argues that case studies are particularly useful when researchers attempt to understand people or a particular problem in great detail. When multiple groups contribute, the information gained is full and extensive. In seeking to establish that extensive information, I followed Yin's model, which indicates that while single-case studies can often yield valuable results it is generally the case that multi-case studies are more robust and viewed with greater regard. In his model of a collective (or multiple) case study the researcher identifies multiple cases and applies the same questioning logic to each, thereby seeking to establish a deep understanding of the participants' perceptions (Yin, 2014). As Creswell notes, it is vital for each bounded case to be carefully selected to ensure that they are representative of the larger population. This allows the researcher to make

generalizations from one case to another, and to find application for the study outside the confines of the test environment (Creswell, 2013).

Student focus groups and other data collection

The interview phase led me to conclude that there were three distinct, bounded cases, as shown in table seven.

Case	Subject Area, Level & Enrollment
High advocacy, high use	Life Science; 100-level; 220
Moderate advocacy, low use	Life Science; 100-level; 235
Low advocacy, low use	**Subject** / **Level** / **Enrollment** Life Science / 100-level / 267 Computer Science / 100-level / 110 Biology / 200-level / 254 Electrical Engineering / 200-level / 153 Finance / 300-level / 187

Table 7: ALP-Enabled Use Cases and Their Descriptions

In identifying these cases, the advocacy of the ALP system reflects the teachers' behaviors, while the use of the system reflects the students' behaviors. In the high advocacy/high use case, the teacher required the use of the ALP system. The class incorporated pre-class lectures that students viewed before lecture. It also had recordings of the lecture, with slides appended, made available to the students. In the moderate advocacy/low use case, the teacher made frequent mention of the ALP system and regularly encouraged students to use it. The course incorporated recorded lectures made available to students after each class session. Finally, in the low advocacy/low use case, the ALP tool was made available to the students, but the teachers rarely if ever mentioned or encouraged its use.

Focus Groups

I wanted to fully understand the students' experiences in these three distinct settings, how the technology influenced their approaches to their classes, how the instructors' use of the technology affected their own thinking about learning, and why the students chose to use (or not use) the active learning technology. To get meaningful answers to those questions, I held three focus group discussions. Each focus group was comprised of students from one of the bounded cases. These focus groups formed the primary data collection mechanism for this study.

I used convenience sampling to populate the focus groups. After the conclusion of the test semester, I used the messaging tool in each of the test courses' learning management system to invite students to participate in the focus group discussions. The invitation indicated to the students the nature and purpose of the focus group session as well as the proposed location and time each was scheduled to occur. This technique yielded a sufficient number of respondents from each case. All student volunteers who responded to the invitation were invited to participate in the focus groups, though not all respondents ultimately attended the sessions. This sampling technique was necessary due to the vagaries of students' schedules, the time constraints of the study, and the disparity in geographical location of the students. A possible limitation of this type of convenience sampling is that the populations for the focus groups were not truly random, which could negatively affect the generalizability of the data these focus group sessions produced. The goal of the focus groups was to contextualize and explain existing quantitative data. By triangulating students' responses with the quantitative data I was able to ensure that, though the focus groups were not random samples, their statements were consistent with

the survey and ALP use data, thereby mitigating the detrimental effects that convenience sampling can have on external validity.

Focus groups are typically a flexible way of engaging a small number of people in an informal discussion focused around a particular topic (Silverman, 2004). Focus groups can be preferable to one-to-one interviews because the informal group dynamic can foster more open and candid responses, especially to students who may be uncomfortable in a more formal interview setting (Barbour, 2007). Additionally, focus groups may help to elicit responses that may be limited in interviews because respondents have not had time or opportunity to fully reflect on the questions being posed. The group dynamic affords more thinking time on each question, thereby allowing each individual to express their own opinions, to respond to others, and to shape each other's ideas (Marshall, 2006). This dynamic also fosters idea generation and brainstorming; the diversity of opinions in the room can lead to deeper conversations that might not be made manifest in a one-on-one interview. Finally, the group setting afforded me the ability to present a brief live demonstration of the tool in order to remind the students of the capabilities of the ALP system. This ensured that all the participants were equally familiar with the ALP system and its capabilities.

I held the focus groups in an empty classroom approximately two months after the test semester concludes. The gap in time between the completion of the semester and the focus groups is a possible limitation of the study, but was a necessary consequence of the mixed methods design. In order to form the focus groups, I needed time to accurately analyze the quantitative data and the data stemming from the instructor interviews. To allow for confusions that this gap may have caused, I reminded the students involved in

the focus groups about the Echo 360 system, demonstrated the various active learning tools the system affords, and provided them with a copy of the course syllabus to help them remember the course content.

Each focus group lasted around 45 minutes. During the focus groups, I guided the discussion and activities, but I allowed the participants to interact as they saw fit. I opened the session with a brief five-minute demonstration of the Echo360 ALP tool, to re-acquaint the participants with the system and to ensure that all participants were familiar with the system's various tools. A series of key questions, which were intrinsically linked to the core research questions (See Appendix D), formed the skeletal structure of the focus group sessions. I also collected from the participants any relevant course-related documents that they brought to the session such as course syllabi, class assignments, and samples of students' notes. The focus group are intrinsically linked to the core research questions. In each focus group session, I used a semi-structured interview technique, which allowed me to respond to the statements of the individual participants while keeping the discussion focused on the core questions (Merriam, 1998).

I gathered qualitative data through three primary mechanisms:

1) I transcribed all the verbal statements of each student and combined them with any messages they sent me (in response to my invitation e-mail) or wrote in response to open-ended questions on the course survey.
2) I gathered course documents from the instructors and students.
3) I took observational notes of students' actions during the focus group sessions.

I recorded all three focus group sessions, and took observational notes as the sessions unfolded. Immediately after each focus group concluded, I made additional notes, indicating key moments and documenting key ideas. I later used this memoing to summarize the overall trends uncovered in the session, and as an aid in establishing

themes (Merriam, 2009). I transcribed all the recordings after the sessions concluded. I coded the transcripts, the post-session notes, the collected documents, and the observational notes using Dedoose, an online qualitative research tool designed for data management, excerpting, coding, and analysis. This information allowed me to identify key categories that emerged in the focus group sessions. From these categories, I extracted evident themes and patterns. I detail the findings of this process in chapter five.

Using Stake's (2010) procedures, I followed that transcription and coding process for each focus group independent of the others, and I analyzed the findings of each session in isolation. Once I identified themes for each case separately, I compared the three sets of themes using a cross-case analysis (Stake, 2010). I simultaneously collected and analyzed the data as it came in, seeking to be responsive to new information and pertinent themes as they emerged (Merriam, 2009). As I coded the data, I referred to previously coded data to validate the incoming information and to assist in the accurate description of key themes (Creswell, 2013). I then cross-referenced the responses of the focus group participants with data collected pertaining to engagement, final grades and ALP system use. Doing so allowed me to find connections between use rates, class performance, engagement, and the frequency of specific thematic responses in the focus group. The distillation of the focus group sessions, course data, and lecture capture data into these key themes and patterns allowed me to reach conclusions about the students' motivations to use the ALP system, and the ways in which they used it.

The results of this qualitative research are credible in that I triangulated the course data and the observational data, ensuring that there was consistency in responses and in the themes that emerged. Additionally, I utilized member checking to further enhance the

study's credibility. Member-checking is the act of allowing participants to review specific descriptions, themes or statements to determine whether these subjects feel that they are represented accurately (Creswell, 2007). These steps helped ensure that the study met the commonly accepted credibility standards for research using the qualitative paradigm.

Validity

My biases may have affected this study's validity. In mixed method studies it is valuable for the researcher to position himself or herself in the study by both identifying his or her experiences with the subject matter and assessing how those experiences could affect the research process (Creswell, 2013). This process gives the readers a full understanding of the context in which the qualitative data were collected and foster a more complete understanding of the results.

My role at the institution involved in the study could be one area bias arose. I am an employee for the university's information technology department. I serve as a system administrator for all learning technologies officially that the university supports, including the learning management systems (Blackboard and Canvas) and all instructional video systems. I have a background in teaching, having worked as a high school English teacher for 12 years, and I work as an adjunct professor of instructional technology at a small liberal arts college. My background in curriculum development and pedagogy and my knowledge of best practices in instructional technology may serve as both a benefit and a detriment to the research study proposed herein.

Because I have a wealth of knowledge on the various pedagogical practices associated with the effective use of technology in education, I could have made

conclusions about the quality of the instruction that the participants in the study did not make. Left unchecked, such a situation could have lead to moments in the focus group and processes in which my biases and interpretations of the practices implemented in the test courses drove the direction of the questioning. To mitigate against this, I bracketed myself to the extent possible from the subject matter by adhering as much as possible to a pre-written set of questions and a pre-determined list of activities. This practice served to prevent my biases from becoming apparent as the questioning and activities unfolded.

At the same time, my background proved to be an asset to the study, as it positioned me well to offer meaningful advice to the instructors involved in the study prior to the beginning of the semester. I was well suited to train the instructors on the use of the technology, and to do so in a manner that encouraged the implementation of pedagogical best practices. This helped the instructors feel confident about the use of the tool, thereby ensuring that there was an adequate integration of the technology into the test classes. Ultimately this helped to drive use rates of the lecture capture system higher in some instances.

In addition to controlling for my own biases, I took additional measures to ensure the validity of this study. Golafshani (2005) states that validity in qualitative research is defined not by the generalizability of the results, but by trustworthiness, rigor, and quality in the qualitative paradigm. I confirmed the validity of the notes and transcriptions that I gathered by member checking. Additionally, I collected data in the form of pre-course and post-course surveys, system data, and focus group discussions. These multiple methods of data collection allowed for me to triangulate data, thereby enabling me to build coherent justification for theme development and ultimately increasing the study's

overall validity. These member checking and data triangulation processes allowed me to trust that the data I collected and the analyses of those data are transferable, credible, dependable, and confirmable.

CHAPTER 4: SELECTION CRITERIA

Recapitulation of Methodology

The purpose of this study is to understand how instructors implement active learning technology, and how the varying degrees of the technology's implementation effect students' engagement and learning outcomes. The study follows the mixed methods paradigm with a quant ➔ QUAL structure in which the quantitative data collected in the first phase of the study informs the formation of distinct, bounded cases that form the core of the second, qualitative phase. The quantitative data details how often the active learning technology is used, by whom it is used, how engaged the students are in their classes, the grades students earn in their classes, and how students and teachers perceive the active learning technology. The emphasis of the study is on the qualitative data collected in the second phase; the qualitative data clarifies and contextualizes the quantitative data, providing a detailed picture of the various ways in which teachers used the technology, the instructional practices of the teachers who used the system, and the ways in which the presence of the technology did or did not yield changes in the teachers' instructional practices. It will also detail how those various implementation strategies and pedagogical approaches affected student behaviors.

The quantitative phase compared data from two distinct groups, shown in table eight. The test group was comprised of seven large face-to-face undergraduate courses held in large lecture halls that were equipped with the Echo360 Active Learning Platform active learning technology. The comparison group was comprised of ten large face-to-face undergraduate courses held in large lecture halls in which no active learning technology was installed.

Group	Subject Area	Level	Enrollment
Test	Life Science	100-level	220
Test	Life Science	100-level	235
Test	Life Science	100-level	267
Test	Computer Science	100-level	110
Test	Biology	200-level	254
Test	Electrical Engineering	200-level	153
Test	Finance	300-level	187
Comparison	Chemistry	100-level	196
Comparison	Chemistry	100-level	185
Comparison	Chemistry	100-level	190
Comparison	Chemistry	100-level	205
Comparison	Chemistry	100-level	203
Comparison	Geography	100-level	180
Comparison	Philosophy	100-level	147
Comparison	Psychology	200-level	133
Comparison	Psychology	200-level	128
Comparison	Sociology	300-level	57

Table 8: Courses by ability levels and groups

I worked with all test group teachers to ensure that they knew the full capabilities of the active learning technology, how to use it, and how to get help in its use. I also provided each of them with standardized text they could opt to include in their syllabus to familiarize their students with the technology. Additionally, I attended each of their classes early in the semester to speak to the students about the technology and to familiarize them with the help and training resources available to them.

Early in the semester I visited all 17 classes to introduce the students to the study, receive their informed consent to participate, and to distribute the first of two surveys. I revisited each class at the end of the semester to administer the second survey. Through the surveys I collected basic demographic data, students' course engagement levels, and students' perceptions of the class and (in the case of the test group) the active learning

technology. After the semester concluded, I downloaded the grade data from each of the 17 courses' online grade books to aggregate learning outcomes data. Finally, I downloaded all usage reports from the Echo360 Active Learning Platform in order to catalog the use of the active learning technology.

Comparing ALP-Enabled and Non-ALP classes

I began the analysis of the survey, course grade, and ALP use data by first exploring the relationship between the comparison group and the test group. That exploration centered on identifying any significant correlations between two dependent variables—students' final class grades, and students' engagement levels— and six predictors. I used the SAS statistical analysis program to conduct a two-level analysis to assess how those two independent variables were affected by active learning technology use, students' grade point average, and whether or not the course was required for degree completion.

To assess those effects on the students' final grade I first identified two levels of predictors. The student population (N = 933) comprised the first level, which I will term student level predictors for the purposes of this analysis. The second level, what I will call the classroom level predictors, is made up of the 17 class units (ten comparison classes and seven test classes) that took part in the study.

My first step was to determine how much variance in students' final grades existed at the classroom level. To that end, I fit a random intercept model and calculated an intra-class correlation (ICC) of .21. This indicates that it is valuable to retain the classroom level as a random second level unit, and that it is proper to analyze this data in a multi-level framework.

I then added six predictors, detailed in table 9. I found a chi-square difference test between the random intercepts model and the model with the six predictors added to be significant, χ^2 (6, N = 933) = 190.6, $\rho < .05$. This suggests that the model with the six predictors fits the data better that the model without the predictors. The proportion of the variance explained (PVE) by all the classroom level predictors was .0722, indicating that the classroom level predictors explain 7.22 percent of the variance in students' final grades. The PVE explained by all the student level predictors was .18. This indicates that a further 18 percent of the variance in students' final grade is explained at the student level.

Predictor	Description	Level
Student GPA centered within classrooms	Signifies how final grades relate to an individual student's GPA falls when compared to the average GPA of the class	Level 1 – student level
Student GPA centered within classroom and its interaction with ALP status	Signifies how final grades relate to how the presence of ALP effects how an individual student's GPA falls when compared to the average GPA of the class	Level 1 – student level
Class required status	Signifies how final grades relate to whether or not a class was required for an individual student's major or minor degree program	Level 1 – student level
Interaction between ALP status and class required status	Signifies how, given the presence of ALP, final grades relate whether or not a class was required for an individual student's major or minor degree program	Level 1 – student level
Classroom ALP status	Signifies whether or not the classroom had the Echo360 Active Learning Platform installed	Level 2 – classroom level
Classroom average GPA	Signifies the mean of all students' grade point averages within a class	Level 2 – classroom level

Table 9: Descriptions of final grade predictors and their levels

There were varying degrees of significance among the six predictors, which are detailed in table 10. Of the six, student GPA centered within classrooms and student GPA centered within classroom and its interaction with ALP status were the two significant predictors of students' final grades; all other predictors were not significant.

Predictor	Level	Significance	Description
Student GPA centered within classrooms	Level 1 – student level	Significant $t(911) = 10.3351$, $\rho < .05$	Students with higher GPA than other students in their class have a higher final grade. 1 point of GPA yields 10.3351 points higher final grade (on a 100-pint scale).
Student GPA centered within classroom and its interaction with ALP status	Level 1 – student level	Significant $t(911) = -4.44$, $\rho < .05$	If a student is in a class without ALP enabled, then their GPA has less of an effect on their final grade than if they were in an ALP-enabled class. For students in an ALP-enabled class, a 1-point increase in GPA has a 10.3351-point effect on their final grade. Students in a class without ALP see a 1-point increase in GPA only have a 4.4 point effect on their final grade. The higher GPA students in the test group see a bigger effect of their GPA on final grades, though it is not known through what mechanism that increased effect stems.
Class required status	Level 1 – student level	Not significant $t(911) = 1.93$, $\rho = .0542$	Whether or not the course is required had no effect on the students' final grade
Interaction between ALP status and class required status	Level 1 – student level	not significant $t(911) = -1.52$, $\rho = .1298$	There is no interaction between whether or not the course is required and the presence of echo in the classroom
Classroom ALP status	Level 2 – classroom level	Not significant $t(911) = 1.69$, $\rho = .0909$	ALP's presence in classrooms had no overall effect on students' final grades
Classroom average GPA	Level 2 – classroom level	Not significant $t(911) = .94$, $\rho = .3483$	Classroom average GPA had no overall effect on students' final grades

Table 10: Descriptions of final grade predictors' significance

I followed the same process to analyze the effects of ALP on students' engagement levels, as measured by the SCEQ. Again, I identified two levels of predictors. The student population (N = 933) comprised the first level, which I will term student level predictors for the purposes of this analysis. The second level, what I will call the classroom level predictors, is made up of the 17 class units (ten comparison classes and seven test classes) that took part in the study.

My first step was to determine how much variance in students' SCEQ scores (engagement) existed at the classroom level. To that end, I fit a random intercept model and calculated an intra-class correlation (ICC) of .069. This indicates that it is valuable to retain the classroom level as a random second level unit, and that it is proper to analyze this data in a multi-level framework.

I then added six predictors, detailed in table 11. I found a chi-square difference test between the random intercepts model and the model with the six predictors added to be significant, χ^2 (6, N = 933) = 45.4, $\rho < .05$. This suggests that the model with the six predictors fits the data better that the model without the predictors. The proportion of the variance explained (PVE) by all the classroom level predictors was .3125, indicating that the classroom level predictors explain 31.25 percent of the variance in students' engagement. The PVE explained by all the student level predictors was .035. This indicates that a further 3.5 percent of the variance in students' engagement is explained at the student level.

Predictor	Description	Level
Student GPA centered within classrooms	Signifies how engagement relates to how an individual student's GPA compares to the average GPA of the class	Level 1 – student level
Student GPA centered within classroom and its interaction with ALP status	Signifies how engagement relates to how the presence of ALP effects how an individual student's GPA compares to the average GPA of the class	Level 1 – student level
Class required status	Signifies how engagement relates to whether or not a class was required for an individual student's major or minor degree program	Level 1 – student level
Interaction between ALP status and class required status	Signifies how, given the presence of ALP, engagement relates to whether or not a class was required for an individual student's major or minor degree program	Level 1 – student level
Classroom ALP status	Signifies whether or not the classroom had the Echo360 Active Learning Platform installed	Level 2 – classroom level
Classroom average GPA	Signifies the mean of all students' grade point averages within a class	Level 2 – classroom level

Table 11: Descriptions of engagement predictors and their levels

There were varying degrees of significance among the six predictors, which are detailed in table 12. Of the six, student GPA centered within classrooms and class required status were the two significant predictors of students' engagement; all other predictors were not significant.

Predictor	Level	Significance	Description
Student GPA centered within classrooms	Level 1 – student level	Significant $t(911) = 3.77$, $\rho < .05$	Students with higher GPA than other students in their class have a higher engagement score. 1 point of GPA yields 5.0095 points higher SCEQ score (on a 120-point scale).
Student GPA centered within classroom and its interaction with ALP status	Level 1 – student level	Not significant $t(911) = -1.32$, $\rho < .1869$	The effect of student GPA on engagement level does not differ regardless of the presence of ALP in the classroom.
Class required status	Level 1 – student level	Significant $t(911) = 2.55$, $\rho = .0109$	Whether or not the course is required had an effect on the students' engagement. Engagement went up by 5.33 points on average if the course was required.
Interaction between ALP status and class required status	Level 1 – student level	Not significant $t(911) = -1.52$, $\rho = .1298$	There is no interaction between whether or not the course is required and the presence of ALP in the classroom.
Classroom ALP status	Level 2 – classroom level	Not significant $t(911) = 1.11$, $\rho = .2654$	ALP's presence in classrooms had no overall effect on students' engagement.
Classroom average GPA	Level 2 – classroom level	Not significant $t(911) = .1.70$, $\rho = .0888$	Classroom average GPA had no overall effect on students' engagement.

Table 12: Descriptions of engagement predictors' significance

The key finding from analyzing the differences between the comparison group and the test group is that the presence of the active learning technology had no meaningful effect on students' engagement and final grades.

This is subsumed in the data above. The ALP variable is indicative of the presence of ALP versus non-ALP classes. The only significant predictor is the ALP interaction with higher GPA: If a student is in a class without ALP enabled, then their GPA has less of an effect on their final grade than if they were in an ALP-enabled class. For students in an ALP-enabled class, a 1-point increase in GPA has a 10.3351-point effect on their final grade. Students in a class without ALP see a 1-point increase in GPA only have a 4.4 point effect on their final grade. Students in the test group with higher GPAs see a bigger effect of their GPA on final grades, though it is not known through what mechanism that increased effect stems.

On the whole, comparing ALP-enabled classes with classes that did not have access to the ALP system revealed few significant predictors. In such a comparison, little evidence arises to indicate that the ALP system is an important element in increasing students' engagement or grades. A further analysis of the data is warranted, however, to take into consideration the variability in the ways that individual teachers make use of the system. To test the hypothesis that variations in instructional practices would drive varying levels of ALP use (and consequently lead to greater variability in students' engagement and grades), I needed to analyze ALP system use data, student engagement data, and student grade data at the course level, then make within-class comparisons between the students who chose to use the ALP system and those who did not.

Data Mixing: Establishing Distinct Cases

To further understand the effects ALP had on course dynamics, learning outcomes, and engagement levels I analyzed data from each of the test courses. The descriptive statistics from each course are shown below in table 13.

Course & N*	Video Views		Minutes		Slides		Notes	
Life Science A N = 211	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	54.033	6.119	714.055	214.575	170.957	137.019	23.114	183.098
Life Science B N = 87	Mean	SD	Mean	SD	Slides not used in this course		Notes not used in this course	
	1.862	5.647	41.856	133.899				
Lice Science C N = 30	Mean	SD	Mean	SD	Slides not used in this course		Notes not used in this course	
	1.387	2.341	19.867	43.614				
Computer Science N = 15	Mean	SD	Mean	SD	Slides not used in this course		Notes not used in this course	
	4.533	6.022	48.500	103.219				
Biology N = 22	Mean	SD	Mean	SD	Slides not used in this course		Notes not used in this course	
	9.773	14.064	197.455	292.643				
Electrical Engineering N = 7	Mean	SD	Mean	SD	Slides not used in this course		Notes not used in this course	
	6.429	5.442	109.571	112.953				
Finance N = 26	Mean	SD	Mean	SD	Slides not used in this course		Notes not used in this course	
	3.923	6.273	69.558	149.657				

Table 13: Descriptive statistics for all ALP test courses. * For all courses, N value reflects survey respondents.

The usage rates in these seven courses vary widely. One course made use of the note-taking and slide interaction capabilities, while seven did not. That same course showed significantly higher use rates of the video tools than any other course. One course showed a moderate level of use of the video tools, while five showed low levels of use. To fully understand this course-level analysis of each of the ALP-enabled classes I needed a working knowledge of the specific ways in which the teachers in those classes integrated ALP into their instruction. Subsequent to the analysis of this course-level data, I conducted interviews with each of the test course instructors. What follows is a presentation of the data revealed in the interviews. Chapter six includes a discussion of the findings related to the interviews and the answers to research question one and its sub questions.

The Interviews

Interview 1: Life Sciences 100 A

Life Sciences 100 A was a 100-level class with an enrollment of 220 students. The instructor used a variety of teaching technologies to deliver course content, and employed a pedagogical practice that he termed a "flipped classroom."

"The basic idea is that this is a flipped class," he said. "The basic flow is that before class the student is expected to read a subsection of a chapter, they're expected to have watched a pre-class video that I have pre-recorded that re-summarizes that same material that they have read, but in my voice – to include more narratives."

He said that he used the ALP system to provide the students with slides to accompany the pre-class videos. He told students that viewing the slides while watching

the pre-class videos replaced the need for in-class lectures. Students would use the information in the slides and videos to complete pre-class homework assignments.

"Then [the students] come to class, and we address activities and questions peppered with what I would call mini lectures in response to how they are doing on those questions or in preparation for the next question," he said.

The instructor said that the ALP system facilitated his teaching by affording him the ability to integrate slides with his pre-class videos.

"I would have flipped the class without Echo because I could use something else to get videos, but adding the slides in made the pre-class stuff much richer," he said.

He said the system also made incentivizing engagement with the pre-class videos much easier. "They are required to watch the pre-class videos. Echo 360 allowed me to track that, and to poke them – to give them rewards for watching," he said. He said that he heard from a number of students that they often would re-watch the pre-class videos in the days leading up to an exam.

Seeing that behavior, he encouraged others to use the system in a similar way. "I tell them that when you're coming up to the exam, that you can re-watch all these videos," he said. "We've had 10 hours of class, but that translates to about 2.5 hours of videos. So in one night, in preparation for the exam, you can watch that in rapid fire."

He also advocated for the use of the system's lecture capture tools. "Also it recorded everything that happened in class. Largely I advocated for that as, 'If you missed class, this is a chance to go back and make that up,'" he said.

Though he frequently told students to watch the recorded lecture sections, he said that he did not think students did that often, unless they missed a class. "I really didn't

see a whole lot of students going back to review. The major thing was for students who missed a class period to use the tool to go back and watch a missed class – not to review material they saw in a class they attended," he said. "I think that was because that first round of material was happening in those pre-class videos, so largely class sessions were already reviewing the content."

Another point of interest in this class is that the teacher offered students who performed poorly on the first exam to improve their grade by completing a class performance contract. "A student who got less than 70% on the first exam can raise that to a 70% if they complete the contract. The contract starts at the end of the first exam and extends through the end of the semester and it essentially codifies all that stuff I mentioned about the structure of the class and lays it out very specifically," he said.

In all, about 35 percent of his class was placed on the contract after the first exam. He said that that the ALP system was an integral part of that contract because it allowed him to easily monitor which students were watching the pre-class videos and to grade that activity.

The instructor said the video recording capabilities of the ALP system led him to dramatically change his teaching practice. "I had been just standing up and repeating, almost verbatim, the stuff I had said the last year. I was saying the exact same thing," he said. He thought that seemed like wasted effort. "We don't all write our own textbooks, so why do we all give our own lectures. Let's come up with a great lecture, have our students watch them, then in class engage them."

He said the technology "allowed me to take that leap, to justify the brick and mortar" by making face-to-face classes about engaging activities not simply lecture. In

doing so, he said that he thinks he's providing a better learning environment for his students. "I think I increase the number of students who are processing the material the way I think they should," he said.

The instructor said that the ALP system came up frequently in his end-of-course evaluation as one of the students' favorite parts of the class. During the interview, he opened his course evaluations and began reading from them. "[Reading from evaluations forms now] The top one says, 'best feature of the class: Echo360.' The fifth one down: 'I like the pre-class videos especially,'" he said. "Next one: 'I like having videos to review. The next: 'Pre class videos is a good way to know what's going to happen in class.'"

He said that students value the pre-class videos because they are a place of comfort for students expecting a traditional class. "The pre-class videos fall into their kind of model that 'I'm going to tell them what they need to know,'" he said. "They want me to tell them what they need to know. The pre-class videos make them feel like, ok, that's their moment."

The ALP system was deeply integrated into Life Science A. The teacher said that it helped him to be a more effective instructor because it was easy to use, it facilitated what he believed to be best pedagogical practices, and it made it possible for him to integrate richer activities into his class.

Table 14 details ALPs effects on content delivery in the course and the manner in which the teacher advocated for its use.

Behavior	Degree of ALP integration	ALP's role
Course delivery, in class	Low	No in-class use
Course delivery, out of class	High	Pre-course videos with slides and notes, recorded lectures for exam review
Echo ALP advocacy	High	Course syllabus, grade recovery contract, daily graded ALP assignments, pre-exam reminders
Echo ALP incentivized?	High	Yes, as graded assignments

Table 14: Life Sciences 100 A ALP integration levels

Interview 2: Life Sciences 100 B

Life Sciences B was a 100-level class with an enrollment of 235 students. The class followed a traditional lecture format, in which students were given readings to complete before class, then listened to and took notes on lectures that he teacher delivered in class. The teacher used a classroom response system called iClicker (not the Echo 360 ALP) to pose questions to the whole class and allow students to respond.

"Usually what I do is I have mainly a standard lecture format where I just do a presentation of material," he said. "I do have, at least once during the class period, an interactive activity of some sort – clicker-based – something like think-pair-share that deals with the material at hand or the material before or the lecture before. Something to keep them interacting with that material."

In this class the ALP system was used primarily as a lecture capture agent; a way to record the lectures and have those recordings fed automatically into the course learning management system site for later review by the students. The teacher regularly advocated for the use of the system, but did not grade students or offer them any extrinsic incentive for using it. The teacher made near-daily announcements about the ALP system,

encouraging students to re-watch the lectures for review. “I would mention to them that if they needed to review that this was a tool that they could use to go back through the material and they could skip through it and go to the part they really needed,” he said.

A distinguishing characteristic of this teacher’s advocacy for the ALP system was the way that he regularly referenced it during one-on-one interactions with his students. “In particular any time anybody came in and said ‘I’m going to miss the class’ or ‘I have missed a class’ I directed them to it – here’s where you can go to get the material you missed,” he said. This consistent referral to the ALP system as a tool used to make up for missed class underscored to students the significance of the recoded lectures, while down-playing the other, more interactive tools the ALP affords.

The teacher said the presence of the ALP system did not change the manner in which he delivered content in any way. He said he approached the content delivery of the class exactly as he had before the system was installed, and he did not change the assignments he required or way he spoke in class. The only change he noticed was that being able to refer absent students to the recorded lectures reduced the amount of time before class, after class, and in office hours that he had to deal with absenteeism.

“It gave me a little more time at the beginning of class and at the end of class,” he said. “I did spend a little more time interacting with students, not saying, ‘Don’t bother me at the moment.’ Just that little bit of extra time I felt that I could interact with students instead of saying ‘I need to put you on hold.’”

Table 15 details ALPs effects on content delivery in the course and the manner in which the teacher advocated for its use.

Behavior	Degree of ALP integration	ALP's role
Course delivery, in class	Moderate	No in-class use
Course delivery, out of class	Moderate	Recorded lectures used to study for exams
Echo ALP advocacy	Moderate	Course syllabus, pre-exam reminders, 1-1 conversations
Echo ALP incentivized?	Low	No incentive

Table 15: Life Sciences 100 B ALP integration levels

Interview 3: Life Sciences 100 C

Life Sciences 100 C was an entry-level life sciences course with an enrollment of 267 students. Each week the students are assigned readings with accompanying question sets. They are also provided with a series of PowerPoint slides that are posted online in the course's learning management site. The teacher said the students are expected to complete the readings, answer the questions, and review the slides before they come to class. In class, the teacher lectures about the content that was presented in the readings. She uses the pre-distributed PowerPoint slides to guide her lecture.

"I post the PowerPoint outlines in advance 1 week at a time, and they will have the whole lecture materials before class," she said. "Then they come into class and they will follow the lecture more efficiently if they have read the chapter."

Each week, after three lectures, the students are given an open-note quiz to assess their retention of that week's lecture content. They are also given three closed-note midterm exams and a final, cumulative exam.

The teacher said that she lectures more than she would like to, but she feels that it is the only way to get through all the material that she needs to cover. She said she tries to engage students though classroom activities, but she is constrained by time and the classroom's seating arrangement, which prevents her from having her students do group

activities. In lieu of that she uses the iClicker classroom response system to get students to interact with questions she poses during class. That participation is un-graded.

"But I try to get feedback from them. I do clicker a lot and I give them the chance to ask questions. I have to really try to get them to interact with me. I have my TA walk around and I try to have hands-on activity as well – a handout or something like that – to kind of participate more," she said.

She does not use the Echo360 ALP system for any of these attempts at in-class interaction. She sees the ALP system as more of a student-centered tool something that she would use to change her teaching. "As far as Echo360, I think students probably have to use it more than I do as a teacher," she said.

Seeing Echo360 as a student-centered tool meant that she made less frequent reference to the system than those teacher who embedded the system more deeply into their instruction. She reminded students about the system once a month or so, during a class session dedicated to reviewing for a midterm or final. "I remind them that we have these lecture captures, she said. "I told them that we have these tools so they can go and re-watch the material. They can rewind, skip ahead, and use it to prepare for the test."

The teacher for this class said that there was no substantive change in the way she presented course material or thought about teaching as a result of the installation of Echo360. She taught the course exactly as she had before it was installed, with the minor change that she encouraged students to re-watch the recorded lectures before their tests.

Table 16 details ALPs effects on content delivery in Life Sciences C and the manner in which the teacher advocated for its use.

Behavior	Degree of ALP integration	ALP's role
Course delivery, in class	Low	No in-class use
Course delivery, out of class	Low	Recorded lectures used to study for exams
Echo ALP advocacy	Low	Course syllabus, pre-exam reminders
Echo ALP incentivized?	Low	No incentive

Table 16: Life Sciences 100 C ALP integration levels

Interview 4: Computer Science 100

Computer Science was an introductory course offered in a mid-sized lecture hall, with an enrollment of 110 students. This course made use of a modified version of the Echo360 ALP system. In all other courses, the system was based on a physical, Internet-connected digital video recording device that automatically turned on to record the class with no required input from the instructor. In the computer science course no such physical device was present. Rather I installed the Echo360 software on the classroom computer. That software offers all the same functions as the hardware device, with the sole exception that it is capable of capturing one less video feed. The recordings still initiate automatically and automatically publish to the course learning management site.

This class followed a traditional lecture format. Before each class session the students were assigned a reading. Then during the class the teacher would lecture about the contents of the reading and provide solutions to problem sets. Students were expected to take notes during the lecture and to use those notes as study materials before the tests. There were two midterm exams and one cumulative final.

The teacher in this class made very little mention of the Echo360 ALP system, and did little to advocate for its use. He put language about the system, including a description of the various tools it affords, in his course syllabus, and he mentioned the

system on the first day of class. "At the beginning of the course, I talked about it on the first day," he said, "but not as the semester went on." The teacher said that if a student came to him with concern about an absence he would point them to the schedule and say the lecture will be online. That happened infrequently throughout the semester however.

The teacher was more aware than any other teacher in the study of the quality of the recorded lectures. He would re-watch his own lectures and would make modifications to the videos as he saw fit. "I edit the video that is recorded in Echo360 before I make those videos available to everybody," He was the only teacher using the system to edit the video content prior to its distribution. He said that he did so because he wanted the videos to be of high quality so that he could re-purpose them as instructional material for the online section of this course.

Like the teacher in Life Sciences C, the computer science teacher left use of the Echo360 ALP system almost entirely up to the students. He viewed the tool as another "value-add or safety net" for the students. He assumed that if he told students the system was available they would chose to use it if they needed it.

The teacher did not offer any incentives for the use of the system, though he did track how often students watched the videos. He noted that he was aware that not many students made use of the system in his class, and he was not surprised by that fact. "Well I track it, so its' possible to see how many views. I think a lot of the students figure, 'I'll just read the book – I don't have to listen to the lectures,'" he said.

The teacher said that knowing the system was installed had zero effect on his approach to teaching and the types of assignments he included in the class. The only way

that Echo360 changed the way he carried himself in the classroom was that it caused him to be more aware of his speech patterns. “I knew I was being recorded to I tried to watch what I said and I tried to not say ‘Um’ or ‘So’ as much,” he said.

Table 17 details ALPs effects on content delivery in Life Sciences C and the manner in which the teacher advocated for its use.

Behavior	Degree of ALP integration	ALP’s role
Course delivery, in class	Low	No use in class
Course delivery, out of class	Low	Recorded lectures rarely used for missed class
Echo ALP advocacy	Low	Course syllabus
Echo ALP incentivized?	Low	No incentive

Table 17: Computer Science 100 ALP integration levels

Interview 5: Biology 200

The biology class was a 200-level course taught in a large lecture classroom; it had an enrollment of 254 students. The course followed a traditional lecture format in which student would be expected to come to class having completed an assigned reading. The teacher would spend the class time lecturing on the material covered in the reading, as the students took notes. The students would use those notes to study for the course’s two midterms and one cumulative final exam.

One feature that differentiated this course from the others in the study is that that class was the only one to make use of the live streaming feature included in Echo360. This tool allows the teacher to share out a link on the course learning management site. Students who are not in the classroom could click the link and watch the class unfold in real time by watching live streaming video of the front of the classroom. This is an entirely one-way stream, meaning that students viewing the class cannot interact with the

teacher or the other students in any way. The teacher said that enabling this feature had no noticeable effect on the rate of attendance in his class.

Other than the live-stream feature, the teacher did not incorporate the ALP system into his teaching. He made no changes to his teaching or content delivery because of the system. He said that aside from mentioning the system to the class in the syllabus and on the first day of class, he never referred to the system in conversation with his students. “I didn’t even think about it. It didn’t make any difference to me what I was doing in the class,” he said.

His assumption was that if the students wanted to use the system, it would be easy for them to do so because the link to it was easy to see in the course Blackboard site. “I use Blackboard a lot, so I know that students are going there. If they see that link they can click it and use the tool,” he said. He did not incentivize students to use the system in any way.

When I shared with him the data concerning the system use by his students he was not surprised. “They have their own way to approach classes, so unless they miss class this is not a tool that they think they need,” he said.

Despite his low advocacy and use of the system, the teacher thought very highly of Echo360. “I really like Echo as a tool. I wish I had more time to look into how students were using it,” he said. “One of the big things is being able to just tell a student – particularly those that have missed it – you can actually see the whole thing. It’s not a substitute, but you don’t need to depend upon someone else’s notes. You can take your own notes.”

Table 18 details ALPs effects on content delivery in Life Sciences C and the manner in which the teacher advocated for its use.

Behavior	Degree of ALP integration	ALP's role
Course delivery, in class	Moderate	Live streamed class lectures online
Course delivery, out of class	Low	Recorded lectures rarely used for missed class
Echo ALP advocacy	Low	Course syllabus
Echo ALP incentivized?	Low	No incentive

Table 18: Biology 200 ALP integration levels

Interview 6: Electrical Engineering 200

Electrical Engineering was a second-year level course with an enrollment of 153 students. The course followed a traditional lecture format, with an emphasis on solving problem sets. Students would be assigned a pre-class reading that would be accompanied by a series of equations and problems to solve. They would complete the problem sets as homework, which they would turn in at the beginning of class. The instructor would use the in-class time to first review the problems from the night before, and then to offer information about the upcoming set of problems.

To review the previous night's problems, the teacher made extensive use of the document camera. He used it to project his hand-written solution to a problem so that students could watch the proper way to address the problem in a step-by-step fashion. The Echo360 system was not initially configured to record the document camera, so I had to modify the system slightly to ensure that it captured this demonstration practice.

The teacher made detailed reference to that Echo360 tool in his syllabus and dedicated a sizable portion of the first day of class to explaining its use. He advocated for it as a way to make up for missed classes and to study for tests. After the first week of

class, though, he never again mentioned the system in class or in conversation with students.

He did not incent students to use the system was not surprised to see that it was only lightly used throughout the semester. “In my teaching there are so many things going on so I don’t use echo 360 as much in the classroom. I just follow what I’m doing and provide it to my students,” he said.

He said that he made no modifications to his teaching due to Echo360, but that he does see value in the tool. He said he would probably try to incorporate it more fully into his instruction if it were to be available in future classes. “The immediate thing that I see is, ‘Here, if you’ve missed, here’s a chance for you to make up,’” he said. “I think I would probably, if I had more time, be more aggressive about pushing it for students that I see are at risk.”

Table 19 details ALPs effects on content delivery in Life Sciences C and the manner in which the teacher advocated for its use.

Behavior	Degree of ALP integration	ALP’s role
Course delivery, in class	Low	No in-class use
Course delivery, out of class	Low	Recorded lectures rarely used for missed class
Echo ALP advocacy	Low	Course syllabus and first day
Echo ALP incentivized?	Low	No incentive

Table 19: Electrical Engineering 200 ALP integration levels

Interview 7: Finance 300

Finance was a third-year level course taught in a large lecture hall. It had an enrollment of 187 students. The teacher called the class a modified lecture, which he described as very Socratic. “I try to get students involved,” he said. “So it’s not a classic lecture class. I have my slides up there, but I use them only as reminders of the stories I’m telling.”

The teacher did not require attendance in his class, in part because he knew they could watch missed lectures using the ALP system and in part because he didn’t want people showing up who would be “bored or distracted by Facebook.” He said this policy changes the classroom dynamic. “I get a smaller number of people – around 50% of the enrolled students – in the classroom, which makes it easier to have some sort of interaction. And the ones that do show up are the ones that do want to participate, or answer questions or present opinions,” he said.

His sole use of the Echo360 ALP system was as a means to distribute recorded lecture sessions to the class. He made a practice of making brief mention of the system each day, as he turned on his lapel microphone, but he rarely explicitly encouraged students to use the system. He said that students primarily used the system if they did not attend class. “I don’t think it was a tool for studying,” he said. “Students wrote in their course evaluations, ‘I like that the classes were recorded so that if I missed one I could go back.’”

He said that he sees the tool primarily as a way to gather data about how often students watch the videos. This, he thinks, could be used to enhance online instruction or

to offer incentives for students to watch course material. “The graduate office is also very keen on digital badges,” he said. “So I’ve looked at the platform they used, and we could integrate the video lectures as part of the badging system to award students for watching additional content.”

He said that the presence of the system did not change his approach to teaching or the activities he assigned to his students. Like the Computer Science teacher, he said that knowing he was being recorded changed the way he spoke in front of the class. “I have been known to blurt out things that I find funny, but that are not the most politically correct things to say,” he said. “Now that I know that I’m being recorded, I think I am watching my mouth a little bit more. Not that I change it completely, but it makes me think twice about the kind of jokes or the kind of things I say.”

This self-censorship was not the only change he saw as a result of the ALP system’s installation. “It also changes for students,” he said. “Sometimes students will say, ‘Oh you didn’t tell us that!’ Well I say if you have doubts, there’s Echo360 – go check that out. And nobody has ever come back to me to complain after I say that. There is actual physical evidence in the form of a videotaped recording.”

Table 20 details ALPs effects on content delivery in Life Sciences C and the manner in which the teacher advocated for its use.

Behavior	Degree of ALP integration	ALP’s role
Course delivery, in class	Low	No in-class use
Course delivery, out of class	Moderate	Recorded lectures used for missed class
Echo ALP advocacy	Low	Course syllabus pre-class mentions
Echo ALP incentivized?	Low	No incentive

Table 20: Finance 300 ALP integration levels

The results of the interviews

For the purposes of the quantitative analysis, the salient point of these interviews was that they revealed three distinct use cases for the ALP system. Table 21 details these use cases. So distinct from one another were these use cases that they served to form the basis for the three bounded cases that made up the core units of the qualitative portion of this study.

Use Case	Subject Area, Level & Enrollment		
High advocacy, high use	Life Science A; 100-level; 220		
Moderate advocacy, low use	Life Science B; 100-level; 235		
Low advocacy, low use	**Subject**	**Level**	**Enrollment**
	Life Science C	100-level	267
	Computer Science	100-level	110
	Biology	200-level	254
	Electrical Engineering	200-level	153
	Finance	300-level	187

Table 21: ALP-Enabled Use Cases and Their Descriptions

In the high advocacy, high use case, the teacher required the use of the ALP system. The class incorporated pre-class lectures that students viewed before lecture. It also had recordings of the lecture, with slides appended, made available to the students. In the moderate advocacy, moderate use case, the teacher made frequent mention of the ALP system and regularly encouraged students to use it. The course incorporated recorded lectures made available to students after each class session. Finally, in the low advocacy, low use case, the ALP tool was made available to the students, but the teachers rarely if ever mentioned or encouraged its use.

There is a high degree of variability within each of the courses, with individual

use rates of the video tools ranging widely from student to student. In all but one of the courses there were many students who made no use of the tools whatsoever. Removing these non-users from the data set provides a clearer picture of how frequently the students who used the tools did so. Table 22 details the descriptive statistics from each of the cases, with the non-users removed.

Case	Video Views		Minutes		Slides		Notes	
High advocacy/ high use	Mean	SD	Mean	SD	Mean	SD	Mean	SD
	54.033	6.119	714.055	214.575	170.957	137.019	270.944	585.691
Moderate advocacy/ low use	Mean	SD	Mean	SD	NA		NA	
	6.750	9.209	158.326	225.407				
Low advocacy/ low use	Mean	SD	Mean	SD	NA		NA	
	7.721	9.575	135.131	209.758				

Table 22: Descriptive statistics by case, with non-users removed

All courses in each of the cases incorporated recorded lectures made available to students after each class session. In order to determine if the manner in which ALP was used affects final grade and/or engagement, I ran a two multiple regressions for each case; in each, I regressed the dependent variable (either final grade or engagement level) on a series of six predictors, detailed in Table 23 below.

Predictor	Commentary
Student Grade Point Average (GPA)	On the pre-course survey, I asked students to self-report their grade point averages entering the class. I knew that GPA would be highly predictive of a students' final grade (and it was my suspicion that it would be predictive of engagement levels), and as such I needed to control for it.
Course Required	I asked students to indicate if the ALP –enabled course was required for their degree program (either their major or minor course of study). I suspected that whether or not the course was required could influence engagement.
Video Views	The ALP system allows me to extract student-level usage statistics, to illuminate how often and in what manner students use the system. The video views statistic is a raw measure of how many times a student opened a video for playback. The statistic does not indicate how much time was spent on any given video, nor does it account for a student viewing the same video multiple times.
Minutes Viewed	Minutes Viewed tracks the total number of minutes that the system played back videos for each student. It does not measure how many minutes the students actually watched the videos (as they could have clicked 'play' then left the computer or opened a new browser tab). Dividing this number by the Video Views number gives me the average time each student spent in the ALP system each time they logged in.
Slides	Teachers can upload their lecture slides into the ALP system, syncing them with the lecture video, and affording students the ability to download the lecture slides. The Slides statistic tracks the number of times each student interacted with a slide (either in the form of downloading it or taking notes on it).
Notes	Students can take digital notes in the ALP system, either appending them as commentary on the lecture slide files or as running commentary synced to the lecture video. The Notes statistic tracks the number of times each student typed a note that was saved into the ALP system.

Table 23: Within-course predictor variables, and their descriptions

Quantitative Analysis Within Cases

Case 1: High Advocacy, High Use

I analyzed the quantitative data from each case independent of the other cases, beginning with the high advocacy, high use case. I first regressed final grade on the six within-course predictor variables. The set of predictors significantly predicted final grade, $F(6,204) = 24.515$, $p<.001$, adj. $R^2 = .402$

The adjusted R^2 of .402 tells me that the combined set of predictors explained about 40 percent of the variance in students' final grades. I looked at each predictor individually, to determine what portion of that 40 percent each predictor accounted for, and which (if any) of the predictors were significant. For the final grade variable, I found that GPA, Course Required, and Video View were significant while the other predictors were not significant; these findings are detailed in Table 24.

Predictor	Significance	Discussion
GPA	Yes	GPA was a significant predictor of final grade. **β** = .590, $t(1) = 10.669$, $p<.001$, semi partial $R^2 = .32$ This suggests GPA uniquely contributes to 32 percent of the variance in final grade. For every 1-point increase in GPA, final grade is predicted to increase 17.911 points on average.
Course Required	Yes	Whether or not a course was required was a significant predictor of final grade. **β** = .150, $t(1) = 2.763$, $p = .006$, semi partial $R^2 = .02$ This suggests that whether or not the course is required uniquely contributes to two percent of the variance in final grade. Students for whom the course is required are predicted to have an increase in final grade of 5.952 points on average.
Video View	Yes	The number of videos viewed was a significant predictor of final grade. **β** = .144, $t(1) = 2.156$, $p = .032$, semi partial $R^2 = .013$ This suggests that the number of videos viewed uniquely contributes to 1.3 percent of the variance in final grade. For every time a student views a video, that student's final grade is predicted to increase .297 points on average.
Minutes	No	The total number of minutes spent watching videos was not a significant predictor of final grade. **β** = -.002, $t(1) = -.676$, $p = .500$, semi partial $R^2 = .001$
Slides	No	The total number of interactions with slides was not a significant predictor of final grade. **β** = .001, $t(1) = .251$, $p = .802$, semi partial $R^2 < .001$
Notes	No	The total number of time students took digital notes was not a significant predictor of final grade. **β** = .004, $t(1) = 1.044$, $p = .298$, semi partial $R^2 = .003$

Table 24: Significance of final grade predictors within the high advocacy/high use case

I then regressed student engagement scores on the six within-course predictor variables. The set of predictors significantly predicted student engagement, $F(6,204) = 2.809$, $p = .012$, adj. $R^2 = .049$

The adjusted R^2 of .049 tells me that the combined set of predictors explained about five percent of the variance in students' engagement scores. I examined each predictor individually, to determine what portion of that five percent each predictor accounted for, and which (if any) of the predictors were significant. For the student

engagement variable, I found that GPA and Video View were significant while the other predictors were not significant; these findings are detailed in Table 25.

Predictor	Significance	Discussion
GPA	Yes	GPA was a significant predictor of student engagement. **β** = .147, $t(1) = 2.104$, $p = .037$, semi partial $R^2 = .02$ This suggests GPA uniquely contributes to two percent of the variance in student engagement. For every 1-point increase in GPA, student engagement is predicted to increase 4.949 points on average.
Course Required	No	Whether or not the course was required was not a significant predictor of student engagement. **β** = .118, $t(1) = 1.714$, $p = .088$, semi partial $R^2 = .013$
Video View	Yes	The number of videos viewed was a significant predictor of student engagement. **β** = .198, $t(1) = 2.343$, $p = .02$, semi partial $R^2 = .025$ This suggests each individual video view uniquely contributes to 2.5 percent of the variance in student engagement. For every time a student views a video, student engagement is predicted to increase .452 points on average.
Minutes	No	The total number of minutes spent watching videos was not a significant predictor of student engagement. **β** = -.099, $t(1) = -1.258$, $p = .210$, semi partial $R^2 = .007$
Slides	No	The total number of interactions with slides was not a significant predictor of student engagement. **β** = -.035, $t(1) = -.446$, $p = .656$, semi partial $R^2 < .001$
Notes	No	The total number of time students took digital notes was not a significant predictor of student engagement. **β** = -.020, $t(1) = -.292$, $p = .771$, semi partial $R^2 < .001$

Table 25: Significance of student engagement predictors within the high advocacy/high use case

Of these findings, a few points stand out as particularly noteworthy. First, as expected, a students' overall grade point average is a predictor of both the final grade the student will receive in the class, and how engaged the student will be in the class. Second, despite the wide array of tools available in the active learning system, the use of those tools—whether it be digital note taking or interacting with slides in any number of ways—is not significantly predictive of increases in either engagement or final grades.

Finally, and perhaps most importantly, in a course in which the teacher advocated for the frequent use of the technology and students responded by using the system regularly, the number of videos viewed correlates to both increased engagement and higher final grades. This correlation suggests that there is a meaningful interplay between watching course videos and students success in the class. The qualitative analysis portion of this study will delve more deeply into exploring the nature of these correlations.

Case 2: Moderate Advocacy, Moderate Use

In the moderate advocacy, moderate use case the slides tool and note-taking tools were so infrequently used as to render any data generated from them meaningless. Thus, I first regressed final grade on the four remaining within-course predictor variables. The set of predictors significantly predicted final grade, $F(4,82) = 17.657$, $p<.001$, adj. $R^2 = .437$

The adjusted R^2 of .437 tells me that the combined set of predictors explained about 44 percent of the variance in students' final grades. I looked at each predictor individually, to determine what portion of that 44 percent each predictor accounted for, and which (if any) of the predictors were significant. For the final grade variable, I found that GPA was significant while the other predictors were not significant; these findings are detailed in Table 26.

Predictor	Significance	Discussion
GPA	Yes	GPA was a significant predictor of final grade. **β** = .624, $t(1) = 7.701$, $p<.001$, semi partial $R^2 = .388$ This suggests GPA uniquely contributes to 39 percent of the variance in final grade. For every 1-point increase in GPA, final grade is predicted to increase 15.121 points on average.
Course Required	No	Whether or not a course was required was not a significant predictor of final grade. **β** = -.031, $t(1) = -.381$, $p = .704$, semi partial $R^2 = .001$
Video View	No	The number of videos viewed was not a significant predictor of final grade. **β** = -.089, $t(1) = -.501$, $p = .618$, semi partial $R^2 = .002$
Minutes	No	The total number of minutes spent watching videos was not a significant predictor of final grade. **β** = .347, $t(1) = 1.961$, $p = .053$, semi partial $R^2 = .025$
Slides	No	NA
Notes	No	NA

Table 26: Significance of final grade predictors within the moderate advocacy/moderate use case

I then regressed student engagement scores on the four pertinent within-course predictor variables. The set of predictors significantly predicted student engagement, $F(4,82) = 4.067$, $p = .005$, adj. $R^2 = .125$

The adjusted R^2 of .125 tells me that the combined set of predictors explained about 12.5 percent of the variance in students' engagement scores. I looked at each predictor individually, to determine what portion of that 12.5 percent each predictor accounted for, and which (if any) of the predictors were significant. For the student engagement variable, I found that GPA and Course Required were significant while the other predictors were not significant; these findings are detailed in Table 27.

Predictor	Significance	Discussion
GPA	Yes	GPA was a significant predictor of student engagement scores. **β** = .256, *t*(1) = 2.538, *p* = .013, semi partial R^2 = .066 This suggests GPA uniquely contributes to 6.6 percent of the variance in student engagement. For every 1-point increase in GPA, the student engagement score is predicted to increase 10.327 points on average.
Course Required	Yes	Whether or not the course was required was a significant predictor of student engagement scores. **β** = .226, *t*(1) = 2.221, *p* = .029, semi partial R^2 = .050 This suggests that whether or not a course was required uniquely contributes to five percent of the variance in student engagement. If the course is required, the student engagement score is predicted to increase 9.925 points on average.
Video View	No	The number of videos viewed was not a significant predictor of student engagement. **β** = -.250, *t*(1) = -1.134, *p* = -.260, semi partial R^2 = .013
Minutes	No	The total number of minutes spent watching videos was not a significant predictor of student engagement. **β** = .391, *t*(1) = 1.775, *p* = .080, semi partial R^2 = .032
Slides	No	NA
Notes	No	NA

Table 27: Significance of student engagement predictors within the moderate advocacy/moderate use case

Notable in the moderate advocacy, moderate use case is the fact that the use of the active learning technology system has no significant correlation on either student grades or student engagement scores. This indicates that the active learning technology is only a significant predictor of student achievement when the technology is used heavily in the class. The qualitative analysis portion of this study, detailed in chapter five, will delve more deeply into exploring this lack of significant correlations, and the behaviors that may drive it.

Case 3: Low Advocacy, Low Use

Finally, I analyzed the same data, following the same procedures, in the low advocacy, low use case. Again, in this case the slides tool and note-taking tools were so infrequently used as to render any data generated from them meaningless. Thus, I first regressed final grade on the four remaining within-course predictor variables. The set of predictors significantly predicted final grade, $F(4,95) = 4.268$, $p = .003$, adj. $R^2 = .117$

The adjusted R^2 of .117 tells me that the combined set of predictors explained about 12 percent of the variance in students' final grades. I looked at each predictor individually, to determine what portion of that 12 percent each predictor accounted for, and which (if any) of the predictors were significant. For the final grade variable, I found that GPA was significant while the other predictors were not significant; these findings are detailed in Table 28.

Predictor	Significance	Discussion
GPA	Yes	GPA was a significant predictor of final grade. **β** = .266, $t(1) = 2.763$, $p = .007$, semi partial $R^2 = .068$ This suggests GPA uniquely contributes to about seven percent of the variance in final grade. For every 1-point increase in GPA, final grade is predicted to increase 4.171 points on average.
Course Required	No	Whether or not a course was required was not a significant predictor of final grade. **β** = -.166, $t(1) = -1.738$, $p = .086$, semi partial $R^2 = .027$
Video View	No	The number of videos viewed was not a significant predictor of final grade. **β** = .072, $t(1) = .399$, $p = .618$, semi partial $R^2 = .001$
Minutes	No	The total number of minutes spent watching videos was not a significant predictor of final grade. **β** = .098, $t(1) = .541$, $p = .590$, semi partial $R^2 = .003$
Slides	No	NA
Notes	No	NA

Table 28: Significance of final grade predictors within the low advocacy/low use case

I then regressed student engagement scores on the four pertinent within-course predictor variables. The set of predictors significantly predicted student engagement, $F(4,95) = 2.123$, $p = .048$, adj. $R^2 = .043$

The adjusted R^2 of .043 tells me that the combined set of predictors explained about four percent of the variance in students' engagement scores. I looked at each predictor individually, to determine what portion of that four percent each predictor accounted for, and which (if any) of the predictors were significant. For the student engagement variable, I found that GPA was significant while the other predictors were not significant; these findings are detailed in Table 29.

Predictor	Significance	Discussion
GPA	Yes	GPA was a significant predictor of student engagement scores. **β** = .207, $t(1) = 2.063$, $p = .042$, semi partial $R^2 = .041$ This suggests GPA uniquely contributes to 4.1 percent of the variance in student engagement. For every 1-point increase in GPA, the student engagement score is predicted to increase 4.189 points on average.
Course Required	No	Whether or not the course was required was not a significant predictor of student engagement scores. **β** = -1.524, $t(1) = -.339$, $p = .735$, semi partial $R^2 = .001$
Video View	No	The number of videos viewed was not a significant predictor of student engagement. **β** = .292, $t(1) = .800$, $p = .426$, semi partial $R^2 = .006$
Minutes	No	The total number of minutes spent watching videos was not a significant predictor of student engagement. **β** = .016, $t(1) = .086$, $p = .931$, semi partial $R^2 < .001$
Slides	No	NA
Notes	No	NA

Table 29: Significance of student engagement predictors within the low advocacy/low use case

As was the case with the moderate advocacy, moderate use case, the most noteworthy point in these data is the lack of any significant prediction of improved

achievement. The qualitative analysis portion of this study will delve more deeply into exploring this lack of significant correlations, and the behaviors that may drive it.

Summary

The first phase of data collection consisted of both quantitative and qualitative components. Survey data, Echo360 ALP use data, and course grades comprised the quantitative data, while coded transcripts of seven interviews with instructors comprised the qualitative data.

I first performed a two-level across-course analysis on data gleaned from seven test courses and ten comparison courses. This analysis measured the degree to which six predictors correlated to two independent variables - students' final class grades, and students' engagement levels. Key findings from these across-course analyses indicated that there is little evidence that presence of the active learning platform is an important element in increasing students' engagement or grades. Given that, I needed to further analyze the data, to take into consideration the variability in the ways that individual teachers make use of the system. I analyzed ALP system use data, student engagement data, and student grade data at the course level, then make within-class comparisons between the students who chose to use the ALP system and those who did not.

This within-course analysis revealed that the presence of ALP was only a significant predictor of grades or engagement in one course. Armed with that knowledge, I conducted interviews with each of the seven test courses' teachers, to discern the nature of their pedagogical approach, their specific implementation of ALP, and the degree to which they advocated for ALP's use. From the analysis of the data generated by these interviews, it was clear that the degree of advocacy varied significantly across the

courses. I further analyzed ALP use data in light of the findings of the interviews, and used the findings to inform the formation of three bounded cases: the high advocacy/high use case, the moderate advocacy/low use case, and the low advocacy/low use case. The stories and findings the stemmed from those cases are detailed in chapter five.

CHAPTER 5: ADDING CONTEXT THROUGH QUALITATIVE DATA

Introduction

The analysis of the quantitative and qualitative data I gathered in the first phase of the study shed light on the role active learning technology has on instructors' practices and on students' engagement and grades. While such information is noteworthy, what I sought to discern in designing this study was not just *what* effect active learning technology has, but *why* it has that effect. To uncover that, I needed to get first-hand accounts from the students who used the system, allowing them to detail the specific circumstances that drove them to use it or disregard it. I used the data from phase one to form three cases: the high advocacy/high use case, the moderate advocacy/low use case, and the low advocacy/low use case. Meaningful stories and significant themes emerged as I delved into the experiences of the students in each of these cases.

The cases

The three cases consisted of between five and eight students. Their populations are detailed in Table 30.

High Advocacy / High Use

7 participants, all in 100-level Life Science

Name (changed for anonymity)	Age	Sex	Final Grade (out of 100)	Engagement Score (out of 120)
Mary	19	Female	91.35	104
Daniel	20	Male	71.56	99
Anna	20	Female	82.29	97
Amber	19	Female	75.63	88
Ashley	21	Female	85.42	81
Sean	19	Male	82.92	87
Julia	19	Female	83.46	74

Moderate Advocacy / Low Use

5 participants, all in 100-level Life Science

Name (changed for anonymity)	Age	Sex	Final Grade (out of 100)	Engagement Score (out of 120)
James	21	Male	86.31	91
Jessica	20	Female	91.15	79
Eric	20	Male	90.93	112
Juan	19	Male	83.42	84
Dylan	19	Male	74.64	80

Low Advocacy / Low Use

8 participants in various classes

Name (changed for anonymity)	Age	Sex	Course	Level	Final Grade (out of 100)	Engagement Score (out of 120)
Jade	19	Female	Comp. Sci.	100-level	83.05	84
Michael	18	Male	Life Sci.	100-level	76.54	71
Emily	19	Female	Life Sci.	100-level	93.50	96
Maria	20	Female	Biology	200-level	88.95	80
Darryl	19	Male	Biology	200-level	72.48	77
Madison	19	Female	Biology	200-level	93.42	84
Jordan	21	Male	Elec. Eng.	200-level	68.19	78
Ellis	22	Male	Finance	300-level	87.93	101

Table 30: Descriptions of participants in three case study focus groups

All three cases were characterized by the pedagogical practices that drove instruction, and the students' reactions to those practices. In the High Advocacy/High Use case the teacher made extensive use of the ALP system and regularly advocated for and incentivized its use, while the students made frequent use of all the various features of the system. In the Moderate Advocacy/Low Use case the teacher advocated regularly for the use of the ALP system but did not incentivize its use, while the students made regular use of the video features in the system but rarely used the other tools the system affords. In the Low Advocacy/Low Use case the teachers rarely, if ever, made mention of the ALP system, and the students rarely, if ever, used any of the features the system affords.

The High Advocacy/High Use case

The High Advocacy/High Use case was a 100-level Life Science course. It was taught in a large lecture hall and had a total enrollment of 220 students. The teacher's pedagogical practices and use of the technology are detailed in the Interview section in chapter 4. In short, the class was marked by a modified flipped classroom structure in which the teacher required students to watch pre-class videos and used the contents of those videos to partially replace in-class lectures. I invited all 220 students in the class to participate in the focus group session. Subsequent to the invitation, 13 students expressed a willingness to participate, but six of them had scheduling conflicts. In the end, seven students participated; all had some key characteristics in common. All but one had a self-reported GPA of over 3.5, all stated that they regularly check their grades online, and all state that it is important to them to do well in all their classes. None of the group are first generation college students, and all had made clear statements about their intended career

paths. Table 31 details the students in this case, specifically the degree to which they interacted with the ALP system, their course grade, their overall GPA, and their declared areas of study.

Name	Videos Viewed	Minutes Viewed	Slides Downloaded	Notes Taken	Course Grade	GPA	Major
Mary	53	1030.5	137	53	91.35	3.94	Mathematics
Daniel	56	627.5	110	213	71.56	3.63	Biology
Anna	53	577	131	0	82.29	3.83	Animal Science
Amber	73	664	568	0	75.63	2.6	Biological Sciences
Ashley	59	607.5	408	68	85.42	3.97	Bio Systems Engineering
Sean	58	630	226	0	82.92	3.79	Microbiology
Julia	53	1030.5	137	109	91.35	3.94	Mathematics

Table 31: Detailed description of participants in High Advocacy/High Use case

Upon conclusion of the High Advocacy/High Use focus group session, I transcribed the recording of the session, and compiled that transcription with all my observational notes, post-session notes, and collected documents. Using Dedoose, I coded the compiled information by searching for word repetition to discern emergent patterns in the students' responses and documents. I searched for relationships among those patterns and broader categories emerged. These categories emerged from the data as central aspects of participants' meanings, feelings, and opinions. I further analyzed these categories, comparing them to the codes and patterns to identify points at which the various categories overlapped. Having identified these overlaps I extracted the emergent themes in the data. I identified three primary themes and two secondary themes. I define a primary theme as any theme that is evidenced in at least three different points of data

collection (wherein a point of data collection is the collected statements of a single individual, the contents of a single document, or the collection of notes about a single individual or single event) and at least ten times overall. I define a secondary theme as any theme that is evidenced in at least two points of data collection and a total of at least five times. The three primary themes from this focus group are:

1) ALP is a useful review tool for tests and exams
2) The teacher's use of ALP for pre-class video distribution helped me learn
3) Using ALP changed how I think about my learning

The two secondary themes from this focus group are:

1) The teacher's use of ALP changed my note-taking behavior
2) Watching the videos multiple times increased my understanding

These primary and secondary themes afford me the ability to make meaning from the students' responses by "writing the emergent story" of the focus group session, and to use that story to address the research questions (Marshall, 2006).

Primary theme 1: ALP is a useful review tool for tests and exams

This theme appeared in seven different points of data collection, and recurred 17 times. On multiple occasions students explicitly said that they used the course videos as a primary means of preparing for tests and exams. The course syllabus encouraged students to use the videos for just that purpose:

"Echo360 is available as a resource for you this semester…You can re-watch important content to help you study for tests and to go over things you don't understand."

Four different students in the focus groups said they used the videos to study. Two more students said that the other features in the tool – specifically the note-taking feature – made studying easier or more productive. On the whole, the notion of ALP as a

study aid was the most agreed-upon concept throughout the focus group. Two students went so far as to state that they were certain that when they used ALP to help them study they performed better on tests than they otherwise would have.

Primary theme 2: The teacher's use of ALP for pre-class video distribution helped me learn

The course syllabus explicitly stated that the content delivery in this course would be "different than traditional classes" because of the integration of required viewing of pre-class videos. In the syllabus there was no specific justification for the implementation of these pre-class videos, but there was a clear description of the process students should follow to complete course work prior to each class, and there was a statement that doing so was the best way to ensure success in the class. More to the point, I collected an additional document from the course instructor that outlined an explicit requirement of engagement in the ALP system. The instructor called this the "Course Contract:" a document given to every student that scored less than 70 percent on the first test.

> The other last thing I should say in terms of the structure of this class is they have a contract. A student who got less than 70% on the first exam can raise that to a 70% if they complete the contract. The contract starts at the end of the first exam and extends through the end of the semester and it essentially codifies all that stuff I mentioned about the structure of the class and lays it out very specifically. People log how they are adhering to the structure. It's a second chance I throw out there for struggling students. Echo is layered into that contract because… Before, if you fail to watch a pre-class video, then you lose that point for that day. You loose 1 out of 35 points, and that's like 2% of your grade. So there's a penalty for missing that. Once you're in the contract, the contract says "You will watch every pre-class video from this point until the end of the semester. And if you fail to watch every video, you void the contract and you loose the reward of moving your first exam to a 70%. So now there's like a bigger carrot there to really fully do this echo360 thing. (Life Sciences class instructor interview)

After the first exam about 45 percent of the class was given the contract, and about 50 percent of those students ultimately completed the course having met the stipulations of the contract. Of the students in the focus group, two were given the option to complete the contract, and both did so. Amber got a 65 percent on the first exam, but ultimately completed the contract, thereby raising that grade to 70 percent. She said, "I know that I got a better grade because of the contract, but I also felt like I got the material more. Like, I felt better about the second and third tests than the first one." Amber watched more course videos than any other student in the focus group, and she said that she watched them as often as she did specifically because of the contract.

In all, six of the focus group students said that the manner in which the teacher used ALP caused them to have a deeper understanding of the material, and two different course documents mentioned higher performance or deeper understanding stemming from the use of the ALP system. All told, "better learning" appeared 16 times across all data points.

Primary theme 3: Using ALP changed how I think about my learning

When students in the focus group talked about ALP helping in their understanding of the course material or learning the content better, they also often spoke in a more metacognitive sense about how the technology caused them to think about their learning process. Daniel, when I asked him if he liked looking at the slides that accompanied the course videos, said, "I think I am more of an autodidact. I kind of checked out when I looked at the slides but if I just watched and listened I was more focused." Other students visibly disagreed with that statement, shaking their heads. Mary said in response, "I think I realized the exact opposite. When I would watch the videos it was like I was always

bouncing between it and the slides and I felt like I was more into it." On the whole, five students verbally indicated a heightened awareness of their learning styles as a result of using ALP, and I noted various forms of metacognitive awareness another five times.

Secondary theme 1: The teacher's use of ALP changed my note-taking behavior

Though there was no specific reference to note-taking in any of the course documents, three students specifically said that ALP changed the way they took notes. Mary said that she thought her notes were better because she wasn't rushed to get them down. She could watch a video without taking notes, then go back and re-watch it, knowing in advance what seemed important and pausing to write notes as needed. Daniel also noted the way in which ALP changed his approach to note-taking, saying on multiple occasions how he preferred having the ability to type his notes rather than hand write them. This allowed him to search the notes for keywords as needed. Overall, three different students mentioned the note-taking feature in ALP a total of eight times.

Secondary theme 2: Watching the videos multiple times increased my understanding

Three students also mentioned that it was the multiple viewing of videos that most increased their understanding of the material. I distinguish this theme from the notion of re-watching content as a study aid, because these mentions were not in reference to improved performance on tests, but rather in connection to a deeper understanding of core course concepts. Mary said that she felt more confident about the "important stuff" because she was able to re-see the portions of the videos that the instructor indicated would be critical factors.

Julia also re-watched the video content often, spending over 17 hours watching course videos over the duration of the semester. She specifically said that she watched all

the videos once only because they were graded. “They were really just homework to me,” she said. Later in the discussion, though, Julia said that she re-watched videos specifically because she did not understand content or key points. Her decision to watch videos multiple times stemmed directly from her desire for deeper understanding. Overall, three students talked about re-watching for understanding a total of five times.

Table 32 details the frequency of the occurrence of the various themes in each of the three points of data collection.

	Frequency in Quotes	**Frequency in Documents**	**Frequency in Notes**
ALP is useful for review for tests	13	2	2
ALP-driven pre-class videos helped me learn	6	2	4
ALP changed how I think about my learning	5	0	5
The teacher’s use of ALP changed my note-taking behavior	8	0	0
Watching the videos multiple times increased understanding	5	0	0

Table 32: Frequency of themes in qualitative data

The story of the High Advocacy/High Use case

Mary performed well in the course and displayed high engagement levels. She was in the course because it is a part of her declared degree program. She stated that she normally does well in science classes, cares about how she does in school, and tries hard in all her classes. She had a very positive view of the ALP system, and she said that it changed both her in-course behaviors and the way that she thought about her learning. She was in the top five percent of students in terms of amount of time spent using the

system, watching over 1,000 minutes of video footage for the class. Much of that view time stemmed from the fact that Mary used the videos as a way to deepen her note-taking practices. She made a habit of watching videos at least twice. “I was able to pay attention the first time rather than take notes. The second time around I could take notes and understand better,” she said. This repetitive viewing was a significant change to Mary’s normal behavior. She said that in a normal class, she would actively take notes during a face-to-face lecture, then refer to them as she did the reading after class. Conversely, in the ALP-enabled class she watched the video without taking notes, then read the text and took notes, then re-watched the video and supplemented her notes with both digital notes taken in the system and revisions to her hand-written notes.

She said that this made her think that she had a better understand of the portions of the reading that the teacher thought were important. Mary said, “I liked how we could watch the pre-class videos. They were very helpful for studying and learning. They would highlight key points from the text, and this helped me remember information better.”

Mary was not the only member of this case that made it a practice to watch the course videos multiple times. Julia also viewed more than 1,000 minutes of video footage, putting herself in the top five percent of overall system use. Unlike Mary, Julia did not re-watch the videos for note-taking purposes, however. Julia viewed the pre-course videos as another form of homework and watched them before class only because they were graded. She approached this class much like she approaches all her classes, occasionally reading the material before class and doing the majority of her studying in the days immediately preceding the tests. During those study sessions, Julia often re-

watched videos multiple times if there was content she did not understand. Julia indicated that the implementation of the ALP did not change her thinking about how she approaches learning, but she did change her behaviors because of the teacher's specific requirements surrounding ALP. Julia said, "I think it gave me more responsibility by requiring me to watch and take notes on the material before class. Echo 360 also allowed me to feel better in class if I didn't understand a topic completely because I knew I had the option of watching the instructor explain the topic on Echo again after class if I needed to."

Despite Julia's frequent use of the ALP system, her engagement score was in the moderate range. This stemmed primarily from her in-class behaviors. She missed class more often than any other student in the focus group (seven times), in part because she felt that watching the videos replaced the need to go to class. "If I was not required to go to class, I would have taken this class completely from the comfort of my home," she said.

Like Julia, many others in the group found using the videos as a review tool to be useful. By far the most common change in behavior that the group attributed to the ALP system was that it changed the way that they reviewed for tests and exams. Daniel had the lowest course grade of the students in the focus group, but he made frequent use of the videos and used the digital note taking tool more than anyone else in the group. He said that the tool changed his behavior because he did almost all of his note taking within the system, rather than on paper. He would watch the videos, then review the PowerPoint slides that the teacher uploaded into the system, and take notes on those slides. "It was a

good tool to go back and look at while studying for tests and exams. It was good to look at the study slides before the exam. Then they were all in one place," Daniel said.

Amber, who had the lowest GPA of the students in the focus group, made no use of the digital note taking feature. She did use the slide download tool more than anyone else, however, and she credits that tool with helping her do better in the class than she thought she would. She said having easy access to the slides changed her behavior in the class because the slides have "more pertinent information that wasn't in the textbook but is relevant to understanding the concepts." When she used those slides for review she did so as she re-watched the course videos. "When I watched them my test scores were significantly better. Recorded lectures were useful to go back and clarify notes I may have missed or re-listen to a part I didn't understand the first time," Amber said.

Amber was one of two students in the focus group that scored lower than 70 percent on the first exam and as a result she needed to follow the Echo360 contract for the remainder of the semester. Amber was initially not pleased with the idea of the contract, but she met its conditions and raised her grade on her first test to a 70 percent. "That contract forced me to watch the videos, and that's when I really started using the slides thing. I was like if I need to do it I will do it, and while the video played I did the slides. So, like, the video would kind of play in the background while I looked at the slides." Amber was pleased that in completing the contract her first test grade went up, but she said the contract's effect was greater than that. "I did way better on the two other tests than on the first. Like it went 65, 78, 79," she said. I asked her if she thought the higher grades stemmed from her using the ALP system and she said yes.

Sean and Ashley were in near uniform agreement that the ALP system helped them feel more prepared as they entered the face-to-face class sessions. Both said that the way the teacher implemented the system into the course changed both their thinking about the course and their behavior in it. They both said that the only part of the system that they thought was "worth it" was the pre-course video delivery. Sean said, "I enjoyed the pre-class videos because I thought it helped summarize what we should know, but I didn't really like the entire class captures because I never really needed to review all of the class." His mention of the entire class captures is in reference to the full-length recordings of the face-to-face sessions that the teacher also had automatically fed into the learning management system course site.

Like Sean, Ashley found the recordings of those face-to-face sessions to be of little value. "I never watched the in-class recordings. I always just watched the pre-class videos and I'd make a few notes about what the key points were. They were very helpful for studying and learning. They would highlight key points from the text, and this helped me remember information better." Ashley was the other student in the focus group that completed the Echo360 contract. She said that it was the contract that drove her to watch all of the pre-course videos. "What I liked about the before-class videos was that it was like [the professor] telling us what we needed to know." She said because she watched those videos she felt like she knew what would be on the test, which made studying easier.

Anna made the most explicit statement about how the teacher's use of the ALP system changed the way she thought about her learning. She said, "It made me think about the readings more. [This course] has taught me a different way to think about the

material. I realized that I really like structure, I mean it made the information and content of the class far more accessible, and I really appreciated that as a student."

On the whole the positive view that students have of the ALP system defined the high advocacy/high use case. While some students viewed the system as simply a way to build more work or homework into the course, all acknowledged in one way or another that there are elements of the system that deepen learning and simplify studying. There was some uniformity in the manner in which students used the system – primarily in that they all watched the pre-class videos and most used those videos as a study aid. This uniformity is almost certainly due to the fact that the instructor not only advocated for the use of the system, but incentivized its use in a variety of ways (e.g. grading the act of viewing the videos, incorporating key information in the videos, and implementing the Echo360 contract). Where the students differed in their use of the system was on the non-video tools it affords, such as note-taking and slide downloads. This lack of consistent use of these features could stem from the fact that he instructor did little to incentivize the use of those tools, or that the students indicated a diversity of preferred learning and studying styles.

The Moderate Advocacy/Low Use case

The Moderate Advocacy/Low Use case was a 100-level Life Science course. It was taught in a large lecture hall and had a total enrollment of 235 students. The teacher's pedagogical practices and use of the technology are detailed in the Interview section above. In short, the class was a traditional large lecture course in which the instructor assigned readings to be completed before class, lectured on the contents of those readings during class, and tested students on their retention of the material on cumulative exams.

The instructor used the ALP system to record the lectures and to post those recordings into the online course site. The instructor advocated for the use of the ALP system as a review tool and as a way that students could take notes or ask questions.

I invited all 235 students in the class to participate in the focus group session. Subsequent to the invitation, 16 students expressed a willingness to participate, but eleven of them had scheduling conflicts or other factors that ultimately precluded their participation. In the end, five students participated. All five students in the focus group scored 75 percent or higher in the class. All five students were aware of the presence of the system in the classroom and the tools that it afforded. All five also said that the teacher would mention the ALP system prior to tests and exams and encourage its use as a study aid. Three of these students used the ALP system at some point during the semester, with varying degrees of frequency, and two of the students made no use of the system. The only way that the three that used the system did so was in watching the recorded lectures; none made use of the note-taking or slide download features. Table 33 details the students in this case, specifically the degree to which they interacted with the ALP system, their course grade, their overall GPA, and their declared areas of study.

Name	Videos Viewed	Minutes Viewed	Slides Downloaded	Notes Taken	Course Grade	GPA	Major
James	11	330	0	0	86.31	3.75	Biology
Jessica	43	684	0	0	91.15	3.39	Food Science
Eric	3	125	0	0	90.93	3.86	Biology
Juan	0	0	0	0	83.42	3.68	Pre-Health
Dylan	0	0	0	0	74.64	2.95	Undeclared

Table 33: Detailed description of participants in Moderate Advocacy/Low Use case

Upon conclusion of the Moderate Advocacy/Low Use focus group session, I transcribed the recording of the session, and compiled that transcription with all my observational notes, post-session notes, and collected documents. Using Dedoose, I coded the compiled information by searching for word repetition to discern emergent patterns in the students' responses and documents. I searched for relationships among those patterns and broader categories emerged. These categories emerged from the data as central aspects of participants' meanings, feelings, and opinions. I further analyzed these categories, comparing them to the codes and patterns to identify points at which the various categories overlapped. Having identified these overlaps I extracted the emergent themes in the data. I identified two primary themes and three secondary themes. I define a primary theme as any theme that is evidenced in at least three different points of data collection (wherein a point of data collection is the collected statements of a single individual, the contents of a single document, or the collection of notes about a single individual or single event) and at least ten times overall. I define a secondary theme as any theme that is evidenced in at least two points of data collection and a total of at least five times. The two primary themes from this focus group are:

1) ALP is a useful review tool for tests and exams
2) The teacher's use of ALP changed my attendance behavior

The three secondary themes from this focus group are:

1) The teacher's use of ALP changed my note-taking behavior
2) Watching the videos multiple times increased my understanding
3) ALP did not change anything about my approach to class

These primary and secondary themes afford me the ability to make meaning from the students' responses by "writing the emergent story" of the focus group session, and to use that story to address the research questions (Marshall, 2006).

Primary Theme 1: ALP is a useful review tool for tests and exams

As was the case in the High Advocacy/High Use case, many students in this focus group saw ALP's main value to be as a study aid. All three students in the focus group who used the ALP system said that they used it primarily as a means for reviewing material prior to tests or exams. This behavior most likely stemmed from the instructor's explicit recommendation to use the ALP system as a way to study. In discussing the manner in which he advocated for the tool's use, the instructor said, ". I would mention to them that if they needed to review that this was a tool that they could use to go back through the material and they could skip through it and go to the part they really needed."

Jessica used the tool more than any other in the focus group, and the bulk of that use was tied to preparing for tests. "I used the recorded lectures a ton when I was studying. I think it helped me remember classes that happened a long time ago, so the information seemed more current for the tests," she said. James agreed, saying that watching the recorded lectures was a way to "improve retention of the course material."

He said, " It gave me an easy way to study. I could read my notes while I watched the recorded class, and my notes made more sense."

Overall, three students referred to ALP as a useful study aid, and all five affirmed that if ALP was installed in a class they had in the future they would use it to study. Additionally, the course syllabus referred to ALP as a resource for studying, and the instructor made verbal statements in class to that effect as well.

Primary Theme 2: The teacher's use of ALP changed my attendance behavior

The effect of ALP on attendance was a significant point of discussion in the focus group session. All three students who watched the videos said that at least one reason they watched the recorded lectures was because they wanted to make up for a day that they missed class. None of them said that they attended class less frequently because of the system, but they were in uniform agreement that knowing ALP was recording class made missing class less stressful. Eric said, "If people miss a class they can go on here and stay caught up with everything, or they can go back and re-watch a lecture if they didn't understand a topic the first time." He said that he missed three classes and he watched all three of the recorded lectures from those missed classes in their entirety. Indeed, he said that the teacher in the course encouraged that behavior. "The professor said in class that if you miss, you can watch the class on Blackboard," he said.

Of note is the fact that Dylan, who made no use of the system whatsoever, said that one of the drawbacks he saw in the system was that it could foster poor attendance. He stated that he never missed a class, and that is why he never used the ALP system. "I didn't ever watch [the recorded lectures] because I had already gone to class. It seems

like you would not come to class if this was always on. But I feel like I need to be in the room."

James used the system more often than most of the students in the class, and he did not view ALP as detrimental to attendance. "Overall, I didn't view this as an excuse to not go to class because there are still clicker points in class and the ability to ask questions during class, however, it was a nice tool to have if I did have to miss class for some reason," he said.

Overall, four of the five focus group participants made statements about ALP's effect on attendance.

Secondary Theme 1: The teacher's use of ALP changed my note-taking behavior

While none of the students used the digital note-taking features of the ALSP system, two of the focus group students engaged in a back-and-forth conversation about the way that the ALP videos changed the way they took notes. James said that he appreciated that he could pause the videos to complete a thought in his long-hand notes without falling behind. As he said this, Jessica nodded and interjected. "I liked to review and sync my notes with this tool. It allowed me to catch up and not get behind if I copied notes slow," she said. These two were the only students to mention note taking as a significant factor, but their lively discussion of the topic served to qualify it as a secondary theme.

Secondary Theme 2: Re-watching the lectures increased my understanding

Two of the three students who watched recordings indicated that doing so led to deeper understanding of the course material. Eric, who watched material related to classes that he did not physically attend, said the he could not say the videos helped him

understand more because he had nothing to compare to. “I can’t say it ‘helped deepen’ my understanding because I missed class so I was like at a zero level of understanding. I guess it allowed me to understand what I missed, but I was not re-watching something I’d already seen,” he said.

Jessica said that stopping the video and taking more detailed notes helped her understand the course content better. James agreed. “I am able to look over things when I need help comprehending different material I did not understand in class,” he said. He said that the act of re-watching the course lectures helped him be sure that his notes were right, and made him feel better going into a test.

Overall, two student mentioned deeper understanding as a significant factor. The course syllabus also made reference to the topic, stating, “You may find using Echo is a way to help you understand concepts that are not initially clear to you.”

Secondary Theme 3: ALP did not change anything about my approach to class

The two students who made no use of the ALP system repeated many times that the technology had no effect on their behavior in class. Juan, who spoke little in the focus group session, said that even though he did not use the system it was nice to know it was available. “I didn’t do anything different, but I guess it felt good to know that it was there,” he said. Dylan nodded and concurred, saying, “it didn’t change the way I approached the class. I kind of forgot it was there because I didn’t need it.” He said that if the teacher had demonstrated the note-taking feature he may have used that, because he types his notes. “But I didn’t really know you could use it for that, so I didn’t.”

Table 34 details the frequency of the occurrence of the various themes in each of the three points of data collection.

	Frequency in Quotes	Frequency in Documents	Frequency in Notes
ALP is useful for review for tests	4	3	5
ALP Changed my attendance behavior	6	0	4
ALP changed note-taking behavior	4	0	2
Re-watching the lectures increased my understanding	6	1	1
ALP did not change my approach to class	7	0	0

Table 34: Frequency of themes in qualitative data from Moderate Advocacy/Low Use Case

The story of the Moderate Advocacy/Low Use case

The group had diverse reactions to the ALP system. All the students who watched videos in the system agreed that the majority of the time they spent using the system was in the week leading up to a test or exam. They also agreed that watching the lectures prior to tests did not necessarily lead to better performance on the tests, but helped with their confidence level going into the test. Two of the participants in the focus group said that the tool was a valuable way to clarify and enrich their course notes. They stated that they would re-watch the lectures with their notes to hand, supplementing the material that they wrote down while in class.

Jessica was perhaps the most ardent advocate for the system. She said that the fact that she could re-hear the lecture was helpful, as she sometimes had a hard time hearing or focusing while in class. “I have trouble focusing in class and being able to go back through the lectures if a really amazing tool. I really liked the Echo tool because we cover a lot of material in 1 hour of lecture and it's hard for everyone to stop and ask him to review a concept,” she said.

Though he never downloaded the slides, James said he valued the ability to re-see the PowerPoints used in the lectures, because he could pause the video and see more of the intricacies of the projected images. He said that this feature helped ease his mind because he felt less pressure to take in everything at once in class. “I also think I was less worried about missing something during class because I knew I could go back and look at it another time,” he said.

Eric said the most valuable aspect of the system was that it allowed him to watch classes that he was unable to attend. When he made that statement, an interesting conversation unfolded in which the students discussed the way in which lecture capture technology seemed to affect attendance. Eric indicated that he used the system to watch classes he did not attend. In fact, he made the argument that watching the lecture was in no way different from attending the class, and he did not consider himself absent from a class if he watched the recording in its entirety. The others in the room disagreed, and stated that they thought it was important to physically be in the room during class. Jessica argued that the greatest drawback of the system was that it would encourage absenteeism, and she indicated that her professor made the same statement at one point during the semester. James disagreed, stating that the system should not be used as an excuse for students to not do the course reading or to avoid taking notes in class. He said that because the instructor included in-class activities using the iClicker student response system he felt he still needed to attend class. “If I know there’s a graded assignment in class with clickers the I’m not going to skip just because it’s recorded,” he said.

Eric’s score of 112 on the SCEQ was the highest not just among the focus group participants but among the entire class. His low use of the ALP (totaling only three video

views for a total of 125 minutes) coupled with his high engagement score indicates that in this class students could be highly engaged with little use of the ALP system. Eric attributed his high level of engagement to the fact that he enjoyed the subject matter and was confident he could be successful. His high self efficacy was a driver in his decision to not use the ALP system as a study aid. “I only used it when I missed class. I knew I could watch stuff or whatever to study, but I just didn’t think I needed it,” he said.

Of note in this case is the fact that two of the participant students did not use the system at all. These participants were far from out of the ordinary in this class. Indeed, of the 235 students in the course, the average number of videos viewed by any one student was 1.8. There were far more students who watched no videos than there were who watched any at all. Non-use of the system was the norm in this class, despite the fact that the instructor made regular reference to the system and spoke with the class about how it could help their studying. Dylan spoke most clearly about the factors that contributed to his choice to never use the ALP system. “I would say it may have been more tempting to use if it was explained to use in a more helpful manner,” he said. “I understood that it was there, but to me it seemed that it was for people who missed class. I didn’t miss class, so I didn’t use it.” Dylan said that if he had known from the start of the class that the digital notes and slide downloads were an option, and if he had been given training on how to use them, he may have been more likely to use them as the semester progressed. “Just watching the notes be written on the slideshows might help me personally. I hear [others in the focus group] talk about the slides and the notes and I don’t know when those things were mentioned in class,” he said.

Juan also never used the ALP system, and he agreed with Dylan that more training on the proper use of the system might have driven him to use it more. His primary thought on why the tool went unused was that there was no clear incentive to use it. “I went to class because there were graded clicker questions. I did the homework activities because they were graded. I think lots of people only do the work that is graded,” He said. He noted that use of the ALP system was not graded, so he felt no need to use it. Some statement from the teacher about the effects the system would have on their graded may have been enough to drive Juan to use the system. “Even if they told us that there was a chance using it would make us do better on tests, I might have used it. I just didn’t think I needed it,” he said.

The experiences of Eric, Juan, and Dylan are indicative of the overarching mindset in the focus group. The students were highly in tune with the instructor’s advocacy for and modeling of the use of the ALP system. They all understood that the tool was a study aid and a way to see lectures that they may have missed, because that is how it was advertised to them. Those who felt they needed help with studying (such as Jessica and James) or who missed class (such as Eric) used the system. Those who did not miss class or see a need for a study aid chose not to use it. The students in the focus group, with the exclusion of Jessica, took little initiative to explore the available tools in the ALP system, and did little to use it in a way that was outside the boundaries of the description of the system the teacher shared with the class. This seems to indicate that a teacher should offer detailed instructions and descriptions of the tools and uses of the ALP system in order to compel the students to make a robust use of the system. On the whole, this group had positive things to say about the ALP system, though they used it

infrequently and its use did not correlate to higher engagement scores or final grades. They found it most valuable as a tool used for review prior to tests, and they used the system to make up for missed classes.

The Low Advocacy/Low Use case

Students drawn from a pool of five courses in which the ALP system was installed but rarely used by the students comprised the Low Advocacy/Low Use case. These courses covered varied content areas and ranged from the 100-level to the 300-level. The courses, and their teachers' pedagogical practices and use of the technology, are detailed in the interview section in chapter 4. In short, these classes were all traditional large lecture courses in which the instructor lectured on the contents of readings and homework activities during class, and tested students on their retention of the material on cumulative exams. The instructors used the ALP system to record the lectures and to post those recordings into the online course site. The instructors put information about the ALP system in their course syllabi and some of them made infrequent verbal mention of the system during class.

I sent an initial invitation to all 971 students enrolled in the classes, asking them to express if they were willing to participate in the focus group session. Subsequent to the invitation, 57 students expressed a willingness to participate. From those, I randomly invited 25 students to attend the session at a specific place and time. In the end, eight students accepted the invitation and attended the focus group session. The eight participants' final grades in their classes ranged from 68 percent to 94 percent. All of the students were aware of the presence of the ALP system in the classroom and the tools that it afforded. The students described varying degrees of advocacy for the use of the

system on the part of their teachers; in each of their courses there was language about the ALP system in the course syllabus. The consensus was that the teachers made reference to the ALP system infrequently or not at all. Four of the eight students never used the ALP system, one watched one video for a total of 30 seconds, and three others made moderate use of the system. The only way that the four that used the system did so was in watching the recorded lectures; none made use of the note-taking or slide download features. Table 35 details the students in this case, specifically the degree to which they interacted with the ALP system, their course grade, their overall GPA, and their declared areas of study.

Name	Videos Viewed	Minutes Viewed	Slides Downloaded	Notes Taken	Course Grade	GPA	Major
Jade	0	0	0	0	83.05	3.75	Electrical Engineering
Michael	0	0	0	0	76.54	3.39	Athletic Training
Emily	0	0	0	0	93.50	3.86	Undeclared
Maria	1	.5	0	0	88.95	3.68	Biology
Darryl	3	30	0	0	72.48	2.95	NEHS
Madison	9	298	0	0	93.42	3.78	Bio-chemistry
Jordan	5	68.5	0	0	68.19	2.96	Electrical Engineering
Ellis	0	0	0	0	87.93	3.88	Finance

Table 35: Detailed description of participants in Low Advocacy/Low Use case

Upon conclusion of the Low Advocacy/Low Use focus group session, I transcribed the recording of the session, and compiled that transcription with all my observational notes, post-session notes, and collected documents. Using Dedoose, I coded

the compiled information by searching for word repetition to discern emergent patterns in the students' responses and documents. I searched for relationships among those patterns and broader categories emerged. These categories emerged from the data as central aspects of participants' meanings, feelings, and opinions. I further analyzed these categories, comparing them to the codes and patterns to identify points at which the various categories overlapped. Having identified these overlaps I extracted the emergent themes in the data. I identified three primary themes and two secondary themes. I define a primary theme as any theme that is evidenced in at least three different points of data collection (wherein a point of data collection is the collected statements of a single individual, the contents of a single document, or the collection of notes about a single individual or single event) and at least ten times overall. I define a secondary theme as any theme that is evidenced in at least two points of data collection and a total of at least five times. The two primary themes from this focus group are:

1) ALP is a useful review tool for tests and exams
2) The teacher's use of ALP changed my attendance behavior
3) ALP did not change my approach to class

The two secondary themes from this focus group are:

1) The teacher's use of ALP changed my note-taking behavior
2) I wish the teacher did more with the ALP system

These primary and secondary themes afford me the ability to make meaning from the students' responses by "writing the emergent story" of the focus group session, and to use that story to address the research questions (Marshall, 2006).

Primary Theme 1: ALP is a useful review tool for tests and exams

As was the case in both other cases, many students in this focus group saw ALP's main value to be as a study aid. All three students in the focus group who used the ALP system said that they used it primarily as a means for reviewing material prior to tests or exams. This behavior most likely stemmed from the instructor's explicit recommendation to use the ALP system as a way to study. The three students who used the system in such a way all said that on the first day of class the teacher told the students that the recorded lectures would be made available and that they could be used to prepare for exams.

Madison used the tool more than any other in the focus group, and the bulk of that use was tied to preparing for tests. She said that the primary benefit was that she could use the recoded lectures to identify the types of content that would appear on the tests. "I was able to understand the notes better due to the "by the way" and "oh don't forget" factor that the instructors always make as comments but don't necessarily write them down. The lecture capture allowed me to understand the comments better and apply them. That really helped me get ready before the test," she said.

Overall, three students referred to ALP as a useful study aid, and six of the eight affirmed that if ALP was installed in a class they had in the future they would use it to study. Additionally, the course syllabus in all eight classes referred to ALP as a resource for studying, and multiple instructors made at least one verbal statement in class to that effect as well.

Primary Theme 2: The teacher's use of ALP changed my attendance behavior

The effect of ALP on attendance was the most significant point of discussion in the focus group session. All three students who watched the videos said that at least one

reason they watched the recorded lectures was because they wanted to make up for a day that they missed class. None of the students that used the system said that they attended class less frequently because of the system, but they were in uniform agreement that knowing ALP was recording class made missing class less stressful. Darryl missed class five times, and three times he used the ALP system to watch a class he missed. “I felt more comfortable when I had to miss a class because I knew that I had a chance to watch it on Echo360,” he said.

One student, Michael, who never used the tool said that when he missed class he “felt less stressed” knowing that the lecture would be recorded. “I was sick and I thought I can watch it later if I don’t go in. But then my friend was like, ‘You didn’t miss anything.’ So I never went and looked for it.

Jordan was a light-to-moderate user of the system, watching portions of five lectures throughout the semester. He felt that the ALP system was detrimental to other students’ attendance in his class, though he didn’t miss any more class than he normally would have. “I try to go to class,” he said. “It made attendance less important, which was mostly a bad thing. Having the structure of regular attendance as well as the ability to ask questions when first hearing the material is very beneficial.”

Overall, five of the eight focus group participants made statements about ALP’s effect on attendance. Three different course syllabi made reference to Echo360 as a means to make up for missed class.

Primary Theme 3: ALP did not change my approach to class

Though the effect of ALP on attendance was the most talked-about topic overall, the theme mentioned by the most students was the fact that ALP had no bearing on their

approach to class. Four of the eight never used the system, and a fifth only briefly looked at it on the first day of the semester. All five of these students said that though they knew Echo360 was available for the class they considered its use either to be optional or extraneous. All five of the students who did not use the system entered the class with a cumulative GPA of 3.4 or higher, and all but one finished the semester with an 83 percent or higher in the class. There was some agreement among these non-users that the ALP system was for students who were struggling in the class. “I didn’t use it because our teacher said it was for if you missed class or didn’t understand the lecture,” said Ellis. “I felt like I didn’t need it, but if I needed extra help I could use [ALP].”

Overall, five students indicated the ALP system their approach to the class completely unchanged.

Secondary Theme 1: The teacher’s use of ALP changed my note-taking behavior

Two of the three students who watched recordings indicated that doing so led them to change the way they took notes. Madison, who primarily used the system to help study for tests, said that knowing the lectures would be recorded changed her in-class behavior with regard to note taking. “I wasn't as worried about getting everything written down because I knew that I could always go back and re-watch the lecture and get it then,” she said. She said that she liked that having access to the system meant she could “just listen” in class rather than try to take notes.

Darryl used the system to re-watch classes that he missed. “When I was watching the video, it was way easier to take notes because I could keep pausing,” he said. He said that he felt the notes he took when he was watching the lectures were more complete than he ones he took while in class. “They were a lot neater and easier to read, that’s for sure.”

Overall, two students mentioned not taking as a significant factor. One course syllabus also made reference to the topic.

Secondary Theme 2: I wish the instructor did more with ALP

One student said during the discussion that he wished that the teacher had made greater use of the Echo360 ALP system. . Jordan said that his teacher used the document camera to project hand-written problems and solutions often during his lectures. He thought that using the ALP system to upload additional slides would have helped to clarify the hand-written examples and to make it clearer what the students needed to study. “I think if [the teacher] made more of an effort to use [ALP] to add more content to the Blackboard course I could have used it more. It would have made studying a lot easier,” he said.

After Jordan made that statement, six more students raised their hands or in other ways affirmed that they thought their teachers should have used more of the tools in the ALP system.

Table 36 details the frequency of the occurrence of the various themes in each of the three points of data collection.

	Frequency in Quotes	Frequency in Documents	Frequency in Notes
ALP is useful for review for tests	7	8	3
ALP Changed my attendance behavior	9	3	4
ALP did not change my approach to class	6	0	5
The teacher's use of ALP changed my note-taking behavior	3	1	1
I wish the instructor did more with ALP	1	0	6

Table 36: Frequency of Themes in Qualitative Data From the Low Advocacy/Low Use Case

The story of the Low Advocacy/Low Use case

The participants' general apathy toward the ALP system defined the Low Advocacy/Low Use case. Half of the students in the focus group never used it, and the other half made little use of it. Madison, who used it more than any other student in the group, watched less than five hours of video footage over the course of the semester. No student in the focus group ever used the note taking or slide download tools. While there were only eight participants in the discussion, their low level of use of the ALP system is representative of the population of all the students, spread across five classes, who made up this case. The average number of views across all students in the case was 4.7, and the average number of minutes watched was slightly over 82. No student in any of the five classes that comprised the case ever used the note taking or slide download tools.

The students in this group were uniform in their agreement that they performed in class at a level they predicted they would achieve entering into the semester. None of them said that the ALP system helped them improve their course performance (though

some did say that the system made studying easier), but at the same time none of them said that the presence of the system lowered their course performance.

The focus group discussion was at its most lively when the topic of attendance came up. There was disparity in their attendance patterns. Darryl, Madison, and Jordan all said that they primarily used the system to make up for absences or to watch portions of the class that they missed because they were either late to class or left class early. Darryl said that on two occasions, both because of the weather, he did not feel like walking to class and he watched the recording of the class instead. He said that if the system had not been installed he probably would have walked to class on those dates, but he was not sure. Madison said that there were three occasions when she left class early to go to work, and that she watched the recordings later. She said she would have left early with or without the system. Jordan said that he never missed class – his primary reason for watching the recorded lectures was to help with homework. When he said that the thought that the ALP system might actually compel students to skip class there was some disagreement among the group. Three students thought that knowing the lectures would be recorded could lead students to miss class, but most agreed that the recordings could work as a sufficient stand in for in-person attendance.

Ellis, who did not use the system, said that he only really saw any value in the ALP system as a means to make up for missed work. “I think it’s great that if you miss class you can use this to not fall behind. I just don’t think anyone is going to use it unless they skip class,” he said. Others nodded in agreement and affirmed that as it was used in their classes, the Echo360 ALP system is most valuable as a way to prevent students from falling behind.

Three of the five courses that comprised the case had language in their syllabi that indicated that Echo360 could be used to watch a lecture that students miss. All three of those syllabi also had language encouraging students to attend class in person whenever possible. One such syllabus worded the attendance policy thus: “While the Echo360 lecture captures will be available for every class, it is advisable that students attend class every day. Doing so will allow you to ask questions, speak with [the instructor] and get help as you need it.”

The second main emphasis of this focus group discussion centered on the nature of the students’ use of the ALP system, and the way that the teachers’ actions and statements drove that use. Students in this group stated that they primarily watched the recorded lectures prior to a test because they either wanted to supplement their studying or review their notes and check them for accuracy. Five students said that their teacher referred to Echo360 at least once in the days leading up to a test, telling students to remember that it was there Among the three participants that watched videos, there was unanimous consensus that watching the videos was most useful right before the test, as a way to “cram.” Madison said she re-watched videos in short bits, to simply re-see the material she found confusing. There was a uniform agreement that access to the videos was not fully helpful because the videos were boring and it was hard to find pertinent information quickly.

None of the students used the videos to take digital notes or to supplement their existing notes, because they either don’t think taking notes helps much or because they felt that their notes were complete enough. Moreover, none of the students used the ALP system to view or download slide. Six of the eight participants affirmed that they did not

use these features because their teacher never told them to. Jade said, "[The professor] only ever talked about the videos – the recorded classes. He never said anything about the notes or the discussion stuff so no one even thought about it." Emily agreed. "I don't think the teacher even knew what the notes thing could do. If he demonstrated that on the first day or something I think more people might use it. But I don't feel like it would help me. Maybe if it was graded."

On the whole, students in this group thought that the idea of lecture capture was a good one because it allowed them to re-watch missed content, but they did could only offer conjecture about the value of the additional tools in the ALP. Seven of the eight thought it would be a good idea for teachers to incorporate more ALP functions into their instruction. "It would at least mix things up a little," said Jade, "so you're not just sitting through a lecture all the time." Maria, who logged into the system one time for a total of 30 seconds, disagreed. "I think it would just be more busy work if you had to do this with the notes or the discussions or the slides. I'm too busy already, so when I logged in that one time I was like 'Nope, not again!'"

Comparing and Combining the Cases

Table 37 shows in which cases each the primary and secondary themes manifested themselves.

	High Advocacy /High Use Primary	High Advocacy /High Use Secondary	Moderate Advocacy /Low Use Primary	Moderate Advocacy /Low Use Secondary	Low Advocacy /Low Use Primary	Low Advocacy /Low Use Secondary
ALP is useful for review for tests	X		X		X	
The teacher's use of ALP changed my note-taking behavior		X		X		X
ALP Changed my attendance behavior			X		X	
Watching the videos multiple times increased understanding		X		X		
ALP did not change my approach to class				X	X	
ALP-driven pre-class videos helped me learn	X					
ALP changed how I think about my learning	X					
I wish the instructor did more with ALP						X

Table 37: Overlaps in the appearance of themes across three cases

Across all three cases, there were eight primary themes and seven secondary themes, with a fair amount of overlap among the cases. One theme appeared as primary in all three cases, one appeared as primary in two cases, one appeared as primary in one case and secondary in another, two appeared as primary in only one case, one appeared as secondary in all three cases, one appeared as secondary in two cases, and one appeared as secondary in only one case. The preponderance of the overlaps in the appearance of these themes was between the Moderate Advocacy/Low Use case and the Low Advocacy/Low Use case. While the High Advocacy/High Use case did over lap with both of the other cases in some way, it did so to a lesser degree. By analyzing how these themes interact and overlap I can paint a full picture of the student experience with the ALP system.

ALP is useful for review for tests

The only theme that appeared as a primary theme in all three cases was the use of ALP as a resource for preparing for tests. In all three cases, the teachers advocated for the use of the ALP system in this manner. In the High Advocacy/High Use case the teacher's advocacy for and incentivization of the use of ALP primarily hinged on using the system to view pre-class videos. The teacher in that case did, though, also advocate for the system as a studying tool. In all three cases, this advocacy took the form of teachers' verbal statements in class and as written statements printed in the course syllabi.

In all three cases, the topic of studying for tests came up in the focus group discussions. Students across the cases varied in the way that they used the ALP system to study for tests. Most used the system as a means to confirm the accuracy of their notes or to supplement their notes with content from classes that they did not attend in person. In two of the cases students used the ALP system to get a better sense of what types of

questions would appear on the tests. Students generally indicated that they thought that the ALP system helped them feel more confident and comfortable entering into a test. A majority of the students that used ALP for studying said they thought it helped them do better on tests, a position that the quantitative data only partially backs up. In the High Use/High Advocacy case (in which, it must be noted, the use of the system was a graded activity) there was a correlation between the use of ALP and the final grade in the course, but that correlation did not exist in either of the other two cases. Some students in the Low Use cases, when discussing the technology as a review tool or study aid, had a deficit view of the system. They focused on the difficulty they had finding specific materials and the technical troubles that arose as they used the system.

ALP changed my attendance behavior

Attendance appeared as a primary theme in two of the three cases: the Moderate Advocacy/Low Use case and the Low Advocacy/Low Use case. Teachers in those two cases made limited mention, either in the syllabus or verbally in class, of ALP as a possible way to make up for missed class. By and large, the focus group participants stated that the presence of lecture capture technology did not alter their attendance patterns in the class. Members of the Moderate Advocacy/Low Use group stated that they saw the presence of lecture capture as an invitation to skip class more frequently, but none of the participants in the focus groups indicated that they missed class specifically because the technology was present. Moreover, one student in that group stated that watching the recorded lectures was tantamount to attendance, and two students in the low performing group said they would have consumed less lecture content if the technology was not available as a resources for watching lectures missed due to absenteeism.

Instructors in at least two classes indicated to their students that they were concerned about the effect that the technology would have on attendance. While it is clear that the technology did not foster improved attendance, there is no evidence to support the notion that the use of this technology drove down attendance. Indeed, if lecturers are comfortable defining viewing class remotely or asynchronously as a form of attending to the lecture, then it could be argued that the technology improved the overall amount of lecture content that students consumed.

It is interesting to note that attendance was not mentioned at all in the High Advocacy/High Use case. In that case, the ALP system was used as a means to add additional content to the course, not simply as a way to document the content presented in lecture. Indeed, the face-to-face sessions of the class often involved group work and small group discussion – activities that could not be captured by the lecture capture agent, which is seen by many as so central to the ALP system. Students in that case's focus group said that watching the recorded lecture sessions served little purpose because there was often nothing to watch or what was recorded was only a small part of a broader activity. In that context, ALP was essentially severed from any discussion of attendance because nearly 100 percent of the use of the system in that class was for outside-of-class, non-lecture activity.

ALP did not change my approach to class

In the Low Advocacy/Low Use case, the notion that the ALP system had no effect on the students' behavior emerged as a primary theme, while it was a secondary theme in the Moderate Advocacy/Low Use case. This theme did not appear in the High Advocacy/High Use case. Students in the two low use cases indicated that they did not

use the system because they did not feel that it was designed for them. In the Moderate Advocacy/Low Use case the teacher would encourage students to use the system to study for tests or to make up for missed days. Students who felt adequately prepared for the tests and who did not miss any class inferred from this advocacy that the ALP system was purely a remediation tool for struggling or absent students, so they did not use it. In the Low Advocacy/Low Use case, teachers made little reference to the system. In those classes, many students simply forgot that the tool was available or didn't know the way that it would be useful to them.

It is likely that this theme did not appear in the High Advocacy/High Use case because the teacher incentivized the use of ALP and modified the course to incorporate the tool into the daily delivery of content. Students essentially had no choice but to approach this class differently than they normally approach classes, and that altered approach was inherently tied to the ALP system.

ALP-driven pre-class videos helped me learn

The High Advocacy/High Use case was the only case in which pre-class videos were a central part of the instruction. So central were these videos to the class that their effect on learning emerged as a primary theme from this case. Students in the focus group made frequent mention of the way that the pre-course videos deepened their understanding and helped to clarify the reading material. Students also said that because they were so often compelled to watch videos in the ALP system, they were more likely to explore the functions of the other tools in the system.

ALP changed how I think about my learning

Perhaps because of the pre-class videos, students in the High Advocacy/High Use case also commonly indicated that the ALP system changed they way they thought about learning. This theme was a primary theme in this case, and it did not appear in the other cases at all. Students in the High Advocacy/High Use case made a surprising number of metacognitive statements during the focus group session. Students in this group said that the way they took notes and prepared for tests was significantly different in the ALP-enabled class, as compared to a traditional class. While the students in all three other cases showed a capacity to think and speak critically and reflectively about their learning behaviors, habits, and preferences, it was only students in the High Advocacy/High Use case who indicated that the ALP system changed those thoughts.

The teacher's use of ALP changed my note-taking behavior

In all three cases, note-taking behavior emerged as a secondary theme. In all three cases most students did not change the way that they took notes, but the few that did change their note-taking spoke about it enough to merit it being labeled a secondary theme. In the High Advocacy/High Use case the primary way that students' saw a change in note-taking was in the use of the technology as a mechanism for enriching and fleshing out the notes they took in class. The students in this group indicated that re-watching lectures that they had already seen in person allowed them to fill in gaps in their notes and clarify areas that they may have initially written incorrectly in their notes.

This re-watching behavior was evident in all three cases, but in different forms. Students often stated that they felt less pressure to take comprehensive notes while in class, because they knew that they could supplement their notes when they re-watched

the videos. In the two low use cases, there were students who used the ALP system to make up for missed classes; they indicated that they could still get notes from a class even if they didn't attend the class in person.

Though the primary way that students changed their note-taking habits centered on re-watching the videos, there were a few students in the focus groups who made use of the digital note-taking tools. These students found it valuable to type up their notes so that they could search through them at a later date and re-visit key topics with little wasted time.

Watching the videos multiple times increased understanding

In the High Advocacy/High Use and Moderate Advocacy/Low Use cases the notion that multiple viewings of videos deepened understanding emerged as a secondary theme. Students often watched videos multiple times in the High Use case, primarily because the pre-class videos tended to be short (less than seven minutes) and re-watching the content took little time. Students who felt that doing watching videos deepened their understanding said that they would use the re-watching to either supplement their notes or to compare their notes to the key points of the reading.

While the high use students thought that their deeper understanding stemmed from more accurate notes, the students in the Moderate Advocacy group found their deeper understanding came when they used the videos to clarify points of confusion. In the Moderate Advocacy/Low Use case the students who thought ALP deepened their understanding said that it did so by allowing the to re-see portions of the lecture that they did not initially understand. Students in this group said that when they found a topic confusing they could re-watch the portion of the lecture that covered that topic. No

student indicated that they re-watched an entire lecture more than once; they always sought out specific portions of a lecture to get more clarity on a confusing topic.

I wish the instructor did more with ALP

In only one case, the Low Advocacy/Low use case, did a student say that he wished his teacher did more with the ALP system. When he did, enough of the other students in the room reacted positively to the thought to merit this idea being a secondary theme for the case. Students in the group said that their teachers made little to no mention of the ALP system, and never advocated for the use of any tool other than the video features. They said that if they had a better understanding of the capabilities of the system, and if they had seen a clear demonstration of how to use the system, they would have used it more and possibly would have enjoyed the course work more.

Qualitative Data Collection Summary

Knowing the varied ways in which teachers implemented active learning technology in their classrooms, and knowing the high degree of variability in the degree to which students used the system, it was necessary to conduct further qualitative data collection in order to contextualize the results of phase one. This chapter has detailed that qualitative data collection process, documenting the formation and conduct of focus group sessions in three bounded cases and describing the process I used to discern primary and secondary themes from the data I collected. Across all three cases eight themes emerged with either primary or secondary frequency:

1. ALP is useful for review for tests
2. The teacher's use of ALP changed my note-taking behavior
3. ALP changed my attendance behavior
4. Watching the videos multiple times increased understanding
5. ALP did not change my approach to class
6. ALP-driven pre-class videos helped me learn
7. ALP changed how I think about my learning
8. I wish the instructor did more with ALP

These themes emerged as a result of inferences I made in analyzing the qualitative data (Creswell, 2011). While they are instructive, they must be integrated into the findings detailed in Chapter Four in order for me to fully address the mixed methods research questions at the heart of this study. I will detail that mixing process, and the findings that emerged from the meta-inferences I made during it, in Chapter Six.

CHAPTER 6: DISCUSSION OF FINDINGS

Recapitulation of purpose, questions, and design

The aim of this study was to explore the degree to which the availability of active learning technology in a classroom affected the teaching practices of teachers, and the degree to which, given those practices, the technology correlated with changes in student grades and engagement levels. To fully address the matter, I designed study that followed the quant => QUAL sequential explanatory multiple-case mixed methods design and used the quantitative data to inform the formation of multiple bounded cases for the second, qualitative phase. I selected this research design because it best fit the questions at the core of my inquiry:

1. How do instructors implement active learning technology?
    a. How do instructors change their practices when the technology is available?
    b. How do instructors perceive active learning technology and its utilization in their classes?
    c. How does using the technology change teachers' thinking about their own instruction?
2. How do various implementations of active learning technology affect student engagement and learning outcomes?
    a. How do students' engagement levels and exam grades correlate with different uses of active learning technology?
    b. How do students' behaviors in and out of class change when active learning technology is implemented in their classes?
        i. Why do students choose to utilize (or not utilize) the features of active learning technology?
        ii. How do specific pedagogical implementations of active learning technology affect students' use of and perceptions of the technology?
        iii. How do specific pedagogical implementations of active learning technology change students' thinking about their own learning?

These research questions hinge on two key elements: the practices of teachers, and the manner in which those practices manifest themselves in student behaviors and

outcomes. The questions led me to a mixed methods design because answering them would require both a detailed understanding of the use of active learning technology (and the outcomes associated with its use) as well as a deep understanding of the contexts that drove the teachers to implement the system by and the students to apply it. As detailed in chapters four and five, I employed various data collection methods at different phases of the study to gather the information needed to find answers to my research questions. Table 38 describes the type of data used to address each research question.

Question	Data collection method
1A) How do instructors change their practices when the technology is available?	Faculty interviews
1B) How do instructors perceive active learning technology and its utilization in their classes?	Faculty interviews
1C) How does using the technology change teachers' thinking about their own instruction?	Faculty interviews
2A) How do students' engagement levels and exam grades correlate with different uses of active learning technology?	Quantitative analysis of system data and survey data
2BI) Why do students choose to utilize (or not utilize) the features of active learning technology?	Student focus groups and quantitative analysis of survey data
2BII) How do specific pedagogical implementations of active learning technology affect students' use of and perceptions of the technology?	Student focus groups and quantitative analysis of survey data
2BIII) How do specific pedagogical implementations of active learning technology change students' thinking about their own learning?	Student focus groups and quantitative analysis of survey data

Table 38: Research questions and the data collection mechanisms used to answer them

The research questions drove my research design. I employed backwards design strategy as a means to settle on the methods I would use to gather information for each sub-question and in each phase of the study. The desired end state of my study was to know how and why students use active learning technology, and if its use is correlated with higher grades or engagement. As such, the primary focus of my research was on the

stories students told of their uses of the active learning technology. Any themes that emerged from those stories would be essential in understanding what, if anything, contributes to an effective implementation of the technology. With student stories at the core of the research, I knew that at least some of the study required a qualitative data collection approach. I implemented focus groups to gather that qualitative data, because I knew that the focus groups would provide the most vivid student depictions of the classroom environments in which active learning technology was used.

To get those depictions, though, I needed to first understand how teachers implemented the technology in their classes. That is, I could not tell the students' stories without first having a setting for those stories. To get a clear understanding of those settings, I knew that, again, I needed to collect qualitative data; those data in this instance would be seven individual narratives told by the seven teachers that used ALP during the study. To get those narratives I relied on one-on-one interviews, because I did not want the statements or opinions of others to affect teachers' depictions of their implementation of the technology.

While I wanted the interviews to be reflective of each teacher's individual pedagogical approach, I also wanted the actual use of the ALP system to inform the direction of the interviews. To allow for that I knew that, prior to the interviews, I would need a comprehensive understanding of how the system was used in each class, so that I could share that information with the teachers during the interviews. To get that understanding, I knew I would need to collect comprehensive quantitative data related to the system and the students who used it, then perform appropriate statistical analyses of those data. This drove my decision to survey the students, to gather data pertaining to

their engagement levels, and to collect comprehensive ALP system data and course grade data. It also led me to collect similar survey, engagement, and grade data from comparison courses in which no active learning technology was deployed. This afforded me the ability to make some general statements of comparison between ALP-enabled classes and non-ALP-enabled classes.

I used the compiled statistical data as the basis for the interviews. Those interviews then led me to see that there were three distinct ways in which ALP was implemented; three bounded cases existed. I was able to use the delineation of these cases to drive further statistical analysis and to inform the formation of the student focus groups. Those focus groups resulted in a wealth of data that I coded and analyzed to identify patterns, trends, and themes. I found eight themes that emerged as either primary or secondary themes in at least one of the three cases. Table 39 lists those themes and where and to what extent they emerged.

Theme	Cases Where Primary	Cases Where Secondary
ALP is useful for review for tests	3	0
The teacher's use of ALP changed my note-taking behavior	0	3
ALP Changed my attendance behavior	2	0
Watching the videos multiple times increased understanding	0	2
ALP did not change my approach to class	1	1
ALP-driven pre-class videos helped me learn	1	0
ALP changed how I think about my learning	1	0
I wish the instructor did more with ALP	0	1

Table 39: Themes and their frequency of occurrence as primary or secondary

Mixing

These themes, in and of themselves, do not constitute findings. Rather they are distillations of the qualitative data that can help to provide context to the quantitative data I previously collected. As is typical in a sequential explanatory mixed methods study, the primary stage of integration (or mixing) of the data fell at the interpretation phase (Creswell, 2008). While the interwoven nature of the data collection in this study required some data integration in an earlier phase (to inform the creation of the cases), the key point of interface of the data occurred once all quantitative and qualitative data had been collected and were awaiting interpretation (Morse & Niehaus, 2009).

As Creswell (2011) notes, mixing during the interpretation phase requires that I draw conclusions that reflect what I learn from the intersection of the quantitative and qualitative data. In a study following a sequential explanatory design such as this one, the data of the second (qualitative) phase is often dependent upon the results of the first (quantitative) phase. Because that was the case in this study, I employed the strategies Crewsell (2011) recommends for connected mixed methods data analysis and interpretation, coming to inferences after both the quantitative and qualitative phases and broader meta-inferences during the interpretation phase. In so doing, I arrived at five findings.

Findings

The wealth of data I accrued over the course of this process led to a five main findings. These findings serve to validate existing research done on lecture capture technology (and similar systems), to expose areas for further study, and to inform the

proper implementation of active learning technology both by universities and by individual instructors. The findings are:

1. Active learning technology use correlates to higher student engagement and grades only when certain instructional conditions exist.

2. Students use active learning technology primarily as a pre-exam study aid, regardless of the degree to which the teacher implements the tool.

3. Students may be prone to change their note taking behavior when active learning technology is available to them.

4. In some cases, the presence of active learning technology changes students' attendance behavior.

5. Students have high praise for active learning technology, but it deepens understanding only when certain instructional conditions exist.

Finding One: Active learning technology use correlates to higher student engagement and grades only when certain instructional conditions exist.

I found that two dominant instructional practices accompanied the use of active learning technology: traditional lecture and the "flipped" classroom. It was only in the flipped classroom that there was a significant correlation between students' use of the technology and either their engagement or their grades. As detailed in chapter four, there were but a few instances in which the use of the active learning technology was a significant predictor of either the final grade or the engagement level. In the High Advocacy/High Use case the number of video views was a significant predictor of both of those dependent variables. None of the other independent variables (minutes of footage viewed, notes taken, or slide downloads) showed any significant correlation in any of the cases. These mixed results align with the varied nature of the findings of Traphagan (2010), Danielson et al. (2014), and Euzent et al. (2011). There was little agreement among their studies of lecture capture systems such as Echo360, with some,

such as Traphagan, finding the systems to have no correlation to higher grades while others, such as Danielson and Euzent, found some positive correlations between the system and grades or students' behaviors. The diversity of findings surrounding technologies such as this suggests that it is the specific implementation of the technology, rather than the technology itself, that contributes to the overall effectiveness of the system.

In the confines of this study the unique conditions present in the High Advocacy/High Use case contributed to an environment in which the use of the active learning technology was positively correlated to both grades and engagement. The instructor in this case made a concerted effort to deviate from a traditional lecture structure, seeking to employ the practice known as "flipping" the instruction. He presented the students with lecture-style material before class, and used the in-class time for activities and discussion. He used the active learning technology to facilitate that effort, both by using it as a video delivery mechanism for his lecture content, and by encouraging the use of the tool for note taking, slide downloads, and discussion. The teacher made it clear that the active learning technology was integral to his flipped class format, as it enabled him to distribute key instructional material to the students, collect data on the students' consumption of that material, and encourage students to interact with the material in meaningful ways. These practices led the students to see the course in a different light; they stated that they were more confident before tests, had a better understanding of the course material, and thought about their approach to learning in a different way. These findings are in keeping with Umbach and Wawrzynski (2005), who

found that when faculty members use active and collaborative teaching techniques student engagement and grades both go up.

This finding, that a flipped class following active learning practices can lead to deeper student engagement reflects the findings of Gasiewski, Eagan, Garcia, Hurtado, and Chang (2011). They found that when students perceive a course to be predominantly focused on lecture, engagement levels decline. Conversely, when students feel empowered to interact with their instructors and are comfortable asking questions in class, their engagement increases. They found that instructor's behaviors are "just as important as those of their students in determining engagement" (Gasiewski et al., 2011).

Perhaps as significant as the finding that active learning technology correlates to higher engagement in a class that follows the flipped model is the lack of any significant correlation in any other class. In both the Moderate Advocacy/Low Use case and the Low Advocacy/Low Use case the teachers' primary delivery mechanism was traditional lecture. In that context they used the active learning technology mainly as a lecture-recording device. They left it to the students to explore the other features the technology offered. When used in this fashion, the students in both cases did not use the technology for any purpose other than re-watching recorded lectures. They followed the lead of their teachers and allowed lecture to dominate the class, with little emphasis on other forms of knowledge acquisition, collaboration, or discussion. In that context, my finding that active learning technology only correlated to a higher engagement level in anon-traditional, non-lecture-driven class confirms the findings of Smith, Sheppard, Johnson, and Johnson (2005). They found that an over-reliance on lecture in college-level science

courses tends to drive down engagement at the course level, and they advocated for more cooperative learning, peer-to-peer interaction, and active learning practices.

Finding Two: Students use active learning technology primarily as a pre-exam study aid, regardless of the degree to which the teacher implements the tool.

In each of the three cases, students' use of the active learning system was surprisingly uniform. Students in all the cases perceived the system primarily as a way to study for tests, though students in the High Advocacy/High Use case exhibited some behaviors that students in the other two cases did not (such as frequently using the notes and slides features of the system). This finding confirms the findings of Sampson (2014) and Woo et al. (2008) that students use active learning technology to prepare for tests.

This uniformity in perception of the system as a review tool was not reflected in uniform outcomes when the system was used in that way. In some cases, students who used the tool to study did no better on tests than students who did not. Some students said that using the tool to study gave them more confidence entering into the exam, but only one student said that she knew that using the system to study improved her grade.

Students in each of the three cases said that their teachers were most likely to mention the use of the active learning technology in the days immediately preceding an exam. A number of the teachers stated that they saw one of the greatest values of the system to be its potential as a review tool or study aid, although no student explicitly said that he or she used the system to study specifically because of the teacher's pre-exam advocacy.

My findings indicate that, across all the courses studied, active learning technology use is not a significant predictor of students' grades. This seems to contradict

the students' and teachers' commonly-held notion that the technology is useful as a means to prepare for exams.

Finding Three: Students may be prone to change their note taking behavior when active learning technology is available to them.

Some students who used the active learning technology exhibited changed approaches to note taking. These changed behaviors took two primary forms. First, some students (exclusively in the High Advocacy/High Use case) used the digital note taking features the system affords to take some or all of their class notes. In keeping with the findings of Kiewra and Fletcher (1984), those students said that they felt they were taking more detailed notes than they otherwise would have. Such note taking, however, did not correlate to an increase in grades. This finding may confirm the work of Mueller and Oppenheimer (2014), who note that hand-written notes yield higher performance on assessments than typed notes.

The second way the system changed note taking behavior was by affording students the ability to use the recorded lectures to supplement their existing notes with further detail. Students in multiple cases spoke of such behavior, and they tended to be heavy users of the system. Only in the case of the High Advocacy/High Use case, though, did their frequent use of the system did correlate to higher grades. This underscores finding one: students may make frequent use of the system, but doing so is not necessarily a predictor of success on tests and exams.

Finding Four: In some cases, the presence active learning technology changes students' attendance behavior.

In the two cases in which traditional lecture dominated the content delivery, students indicated that the presence of the active learning system contributed to a change in their attendance patterns in class. Students in these classes said that there were times when they did not attend class because they knew that they could view the content online later. They also expressed less consternation about an absence because they felt they could rely on the recorded lecture as a means to make up for an absence. This confirms the finding of Traphagan (2010) that lecture capture lowers the rate of attendance and has little net effect on student scores. There is no data in my study to indicate that changes in attendance behavior in ALP-enabled classes have any effect on student scores or engagement, either positively or negatively.

Finding Five: Students have high praise for Active learning technology, but it deepens understanding only when certain instructional conditions exist.

As Taplin et al. (2011) and Woo et al. (2008) found, I found in this study that students liked the active learning technology and they thought that more teachers should use it. As was the case in this study, Taplin et al. (2011) found that students overwhelmingly praised the idea of lecture capture. Their findings indicate, like mine, that overall use of the lecture capture systems was low despite the high praise the technology receives from students.

While students in all three cases had a positive perception of the active learning technology, not all students thought that the system contributed to a deeper understanding of the course material. In the High Advocacy and Moderate Advocacy cases the students agreed that the system helped deepen their understanding of key course content. In both

cases, the students said that this deeper understanding stemmed from repeated viewing of the course lectures or mini lessons. They said that they viewed the recordings as a resource they could use to review topics that confused them or that they knew would be on the test.

It is worth noting that this perception of the technology as contributing to deeper understanding did not exist in the classes in which the teachers rarely (if ever) made mention of the system. This implies that students perceive value in the system when they see their teachers demonstrating a belief in the system's value. When teachers do not advocate for the use of the tool students do not see the tool as being a valuable resource.

Findings Summary

In short, what this study shows is that the effectiveness of active learning technology is tightly coupled with the instructional practices that accompany the implementation of the technology. Students will use the tool as a way to study for tests, regardless of how the teacher implements it in the class. Teachers who use the tool simply to record lectures, make no modifications to their instruction, and leave students to use the tool as they wish are likely to see little change in students' engagement or grades. Teachers who frequently advocate for the use of the system and express to their students the system's value as a learning tool may find that their students achieve a greater understanding of the course material. Most significantly, teachers who use the system to facilitate a move away from traditional lecture and who embed use of the system into the day-to-day operations of the class may find that active learning technology use predicts increases in engagement and course grades.

Recommendations for action and further research

This study reveals that there are diverse ways that students interact with active learning technology, and that those diverse approaches are a result of the specific pedagogical practices of their teachers. On the whole, the system does not radically alter either the performance of the students in class or their study behaviors. This study indicates that there is positive perception of active learning technology among students, but that the underlying effects on student learning outcomes and engagement are either not significant, or are only significant if the instructors encourage specific behaviors with the system. From this new position of understanding surrounding active learning technologies, I am able to make a series of recommendations for institutions that have implemented (or are planning to implement) active learning systems, and for the instructors who teach at those institutions. I also see additional opportunities for further research that could build upon and draw from this study.

We now know that simply installing an active learning system in a classroom is not conducive to increased student learning outcomes or higher student engagement levels. Indeed, a passive implementation of the system may simply encourage a continued reliance on the traditional lecture format that has been repeatedly found to be nonconductive to students' learning. Based upon my findings, I have three recommendations:

1. Institute a course redesign initiative in conjunction with active learning systems.
2. Encourage teachers to advocate for the use of the active learning system.
3. Investigate what drives teachers to move beyond lecture.

Recommendation One: Institute a course redesign initiative in conjunction with active learning systems.

The only circumstance in which the use of the ALP system correlated with higher scores and engagement was when it was used as part of a flipped classroom model. It was outside the scope of this study to investigate the effectiveness of the flipped class model or to make causal statements about the effectiveness of ALP, but the significant correlations I uncovered in this study should not go unheeded. I recommend that institutions seeking to implement active learning technology only do so if a course redesign program accompanies such an implementation. This program would provide for teachers a comprehensive set of strategies to fully incorporate the various active learning system tools. Additionally, the program could educate instructors on the drawbacks of traditional lecture and provide examples of how an active learning system can help to move instruction away from that traditional framework.

Further study is needed to determine the full effects of a flipped class content delivery strategy, and specific investigation needs to be done on the effectiveness of an active learning technology system as a central component of a flipped class. At the very least, though, institutions can benefit by knowing that teachers of a flipped class can expect higher student engagement and overall grades if those students use an active learning system. This could serve as a starting point for meaningful discussions about the improvement of pedagogical practices in large-enrollment courses.

Such a training or course redesign initiative would of course come with a cost. It is common in the learning technology industry for vendors to tout the value of their products by making claims about the ease of use, the technological innovation, or the cost

savings to the institution that will accompany the new system. Rarely do these firms comment on the degree to which their products actually affect students' learning outcomes. Now armed with a deeper understanding of what is required to affect change in students' engagement and grades, universities can make more informed decisions surrounding the true cost of proper implementation of an active learning system.

Recommendation two: Encourage teachers to advocate for the use of the active learning system.

Absent a broader course redesign, schools with active learning systems should at the very least encourage their teachers to advocate for the frequent and proper use of the system. This study shows that even moderate levels of advocacy for the use of the ALP system, while not yielding any significant correlation with engagement or grades, resulted in students perceiving that they had a deeper understanding of the course material. I used final course grades as the primary metric of learning outcomes, and did not measure students' understanding through any other means. Further research, focused on quantifying students' understanding of core concepts in ALP-enabled classes, could confirm or refute the statements students in the High and Moderate advocacy cases made concerning their levels of understanding.

Because this study indicates that students perceive a deeper level of understanding when they re-watch videos as a way to supplement their notes (not as a means to make up for missed class), teachers should encourage that behavior. This encouragement should go beyond a passive advocacy (such as text in the syllabus or start-of-semester verbal statements in class) and should instead be regular, specific, and clear. Teachers should identify portions of each class that students should re-watch, and regularly remind

students to do so. They should also model the appropriate use of the system with in-class demonstration.

Recommendation Three: Investigate what drives teachers to move beyond lecture.

This study also revealed an intriguing set of teacher behaviors that merit further investigation. The teacher whose course ultimately ended up becoming the High Advocacy/High Use case was highly motivated to incorporate new pedagogies and technologies into his teaching. I am curious to investigate his motivations. What compelled him to radically alter his teaching when other instructors with access to the system showed little interest in changing their pedagogy? What hurdles to pedagogical change did the other teachers with access to ALP perceive that he did not? Did the presence of the technology serve as a motivator for his change? How informed is this teacher on current research pertaining to instructional best practices? How can the conditions that drove this teacher to redesign his teaching be replicated? Deeper investigation into these questions, perhaps in the form of a mixed methods narrative study in which the teacher's stories illuminate and contextualize the data coming out of his course, could help to solidify our understanding of what is needed to effect real pedagogical change in higher education.

Conclusion

This mixed methods study offers a detailed picture of the effects of active learning technology on the teachers and students in large enrollment classes. I found that in certain circumstances active learning technology can be a significant predictor of change in engagement and final grades, and students' perspectives on the system are rich and varied. While the findings of this study cannot be generalized beyond the confines of

the courses referenced herein, lessons surrounding both the technology and its implementation abound. Simple installation of the technology is not a panacea and specific steps need to be taken to ensure its proper implementation. This study, and the themes and findings in which it resulted, can act as a guide for how teachers should think about active learning technology, how they incorporate it in their classes, and how institutions deploy these systems.

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APPENDIX A: INFORMED CONSENT DOCUMENTS

Consent to Participate in a Research Study
ECHO 360'S EFFECT ON STUDENT LEARNING AND ENGAGEMENT

Principal Investigator: Jeremy Van Hof, Office of Information Technology Services, University of Nebraska-Lincoln
Faculty Advisor: Allen Steckelberg, PhD, University of Nebraska-Lincoln

Invitation to participate in a research study

Jeremy Van Hof invites you to participate in a research study about the effects that the Echo 360 lecture capture technology has on student learning outcomes in undergraduate math courses. The study is funded in part by the Office of Academic Affairs at the University of Nebraska-Lincoln.

Description of Lecture Capture

Lecture capture technology is any technology that creates a recording of a class's lecture and other activities and makes that recording available for students to view at a later date. The lecture capture system used in this study uses technology from a vendor called Echo 360. The Echo 360 system will capture (record) a video feed of the classroom, an audio feed of the classroom, and any digital materials displayed on the instructor computer (e.g. a PowerPoint presentation or a document camera). The recording is processed on a digital recording device housed in the classroom, then sent via the Internet to Echo 360's cloud server. Once processed - usually about an hour after the conclusion of the class - the capture becomes available to students and instructors via the 'Echo Center' - a utility installed in Blackboard that serves as a video player for the captures. Only students enrolled in a class can access the captures made for that class in the Echo Center. The Echo Viewer allows students to bookmark key points, post questions for other students or the instructor, and move quickly from section to section within the capture. The Echo Center allows instructors to view viewing statistics, including the time each student spent viewing a capture and the frequency that certain sections of the capture were viewed.

Lecture Capture technology is not new. It has been used for years as an instructional tool by teachers looking for a way to archive the proceedings of a class in order to re-view the content at a later date. However, there is no clear consensus in the existing literature on the question of whether or not lecture capture actually improves student learning outcomes.

Description of subject involvement

Control group:
The control class will proceed with no modification to regular course delivery. If you are in the control group and you agree to be part of the research study, you will be asked to complete two surveys – one in September of 2015 and one in December of 2015. These surveys will ask you to report your name, age and sex. Additionally, you will be asked to disclose your current

GPA and your area of study at UNL. The majority of the survey questions will ask you to report information pertaining to your engagement in this class. You will also grant your instructor permission to disclose with the primary investigator your scores on class tests and in the class overall.

Comparison group:
The treatment class will have not access to the Echo 360 lecture capture system. If you are in the comparison group and you agree to be part of the research study, you will be asked to complete two surveys – one in September of 2015 and one in December of 2015. These surveys will ask you to report your name, age and sex. Additionally, you will be asked to disclose your current GPA and your area of study at UNL. The majority of the survey questions will ask you to report information pertaining to your engagement in this class. You will also grant your instructor permission to disclose with the primary investigator your scores on class tests and in the class overall.

Benefits

Control Group:
Students in the control class will see no modifications to the normal math class experience. Although you may not directly benefit from being in this study, others may benefit because this study will help reveal the degree to which lecture capture technology affects student learning. The university will use that information to help determine whether or not to implement lecture capture technology across the campus.

Treatment Group:
Students enrolled in the treatment course will have access to all course recordings regardless of whether they agree to participate in the study or not. Although you may not directly benefit from being in this study, others may benefit because this study will help reveal the degree to which lecture capture technology affects student learning. The university will use that information to help determine whether or not to implement lecture capture technology across the campus.

Risks and discomforts

There are no risks associated with this study.

Compensation

There is no compensation for your participation in this study.

Confidentiality

The University of Nebraska-Lincoln Institutional Review Board is the organization responsible for the safe and ethical implementation of this study.

We plan to publish the results of this study, but will not include any information that would identify you. There are some reasons why people other than the researchers may need to see information you provided as part of the study: The University of Nebraska-Lincoln Institutional Review Board is responsible for making sure the research is done safely and properly; The University of Nebraska-Lincoln or the Office of Academic Affairs may use the data as a means to improve or implement learning strategies.

To keep your information safe, the researchers will assign random numbers to each student involved in the study. Student names will be coded at the time of data collection, and the list containing student names and code numbers will be stored separately from the collected data. After the data is collected and coded, the list containing student names will be destroyed.

Storage and future use of data

- The data you provide will be stored in a locked office in the campus of the University of Nebraska-Lincoln
- The researchers will retain the data for five years.

- Digital data related to the study will be stored on a portable storage device that will be kept in a locked office on campus.
- The researchers will dispose of your data by shredding all documents and deleting all digital files containing information related to the study
- The data may be made available to other researchers for other studies following the completion of this research study and will not contain information that could identify you.
- The University Chief Information Officer or the Office of Academic Affairs may use the data generated in the study to improve or implement current of future teaching and learning strategies. All data used for these purposes will be anonymous.

Voluntary nature of the study

Participating in this study is completely voluntary. Even if you decide to participate now, you may change your mind and stop at any time. If you decide to withdraw early you

name will be removed from the coded list and all data referencing you will be destroyed. Regardless of your participation in the study, if the course in which you are enrolled has its class sessions recorded, you will have access to those recordings.

Contact information

If you have questions about this research, you may contact Jeremy Van Hof at jvanhof@unl.edu or 402-472-4266 or Dr. Allen Steckelberg at asteckelberg1@unl.edu or 402-472-5491

If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher(s), please contact the Office of Research Responsibility 312 N. 14th St., Ste 209, Alex West Lincoln, NE 68588-0408 402-472-6965.

Consent

By signing this document, you are agreeing to be in the study. You will be given a copy of this document for your records and one copy will be kept with the study records. Be sure that questions you have about the study have been answered and that you understand what you are being asked to do. You may contact the researcher if you think of a question later.

I agree to participate in the study.

_____
Printed Name

_____ _____
Signature Date

APPENDIX B: SCEQ AND SCEQ SCORING

STUDENT ENGAGEMENT QUESTIONNAIRE

To what extent do the following behaviors, thoughts, and feelings describe *you, in this course.* Please rate each of them on the following scale:

5 = very characteristic of me
4 = characteristic of me
3 = moderately characteristic of me
2 = not really characteristic of me
1 = not at all characteristic of me

1. _____ Raising my hand in class
2. _____ Participating actively in small group discussions
3. _____ Asking questions when I don't understand the instructor
4. _____ Doing all the homework problems
5. _____ Coming to class every day
6. _____ Going to the professor's office hours to review assignments or tests, or to ask questions
7. _____ Thinking about the course between class meetings
8. _____ Finding ways to make the course interesting to me
9. _____ Taking good notes in class
10. _____ Looking over class notes between classes to make sure I understand the material
11. _____ Really desiring to learn the material
12. _____ Being confident that I can learn and do well in the class
13. _____ Putting forth effort

14. _____ Being organized

15. _____ Getting a good grade

16. _____ Doing well on the tests

17. _____ Staying up on the readings

18. _____ Having fun in class

19. _____ Helping fellow students

20. _____ Making sure to study on a regular basis

21. _____ Finding ways to make the course material relevant to my life

22. _____ Applying course material to my life

23. _____ Listening carefully in class

[Source: Handelsman, M. M., Briggs, W. L., Sullivan, N., & Towler, A. (2005). A measure of college student course engagement. *Journal of Educational Research, 98,* 184-191.]

SCEQ: STUDENT ENGAGEMENT SCORING

[Source: Handelsman, M. M., Briggs, W. L., Sullivan, N., & Towler, A. (2005). A measure of college student course engagement. *Journal of Educational Research, 98,* 184-191.]

For the total score, simply add up the answers. For each subscale, simply add up the answers for the questions in each subscale.

SKILLS ENGAGEMENT SUBSCALE

4. _____ Doing all the homework problems
5. _____ Coming to class every day
9. _____ Taking good notes in class
10. _____ Looking over class notes between classes to make sure I understand the material
13. _____ Putting forth effort
14. _____ Being organized
17. _____ Staying up on the readings
20. _____ Making sure to study on a regular basis
23. _____ Listening carefully in class

EMOTIONAL ENGAGEMENT SUBSCALE

7. _____ Thinking about the course between class meetings
8. _____ Finding ways to make the course interesting to me
11. _____ Really desiring to learn the material
21. _____ Finding ways to make the course material relevant to my life
22. _____ Applying course material to my life

PARTICIPATION/INTERACTION ENGAGEMENT SUBSCALE

1. _____ Raising my hand in class
2. _____ Participating actively in small group discussions
3. _____ Asking questions when I don't understand the instructor
6. _____ Going to the professor's office hours to review assignments or tests, or to ask questions
18. _____ Having fun in class
19. _____ Helping fellow students

PERFORMANCE ENGAGEMENT SUBSCALE

12. _____ Being confident that I can learn and do well in the class
15. _____ Getting a good grade
16. _____ Doing well on the tests

Scoring this questionnaire is a simple matter of summing the values of each student's responses. To find the values in each of the subscales measuring the four factors of engagement, the totals of the following questions are summed:

Skills: questions 4, 5, 9, 10, 13, 14, 17, 20, 23

Emotional: questions 7, 8, 11, 21, 22

Participation: 1, 2, 3, 6, 18, 19

Performance: 12, 15, 16

APPENDIX C: INSTRUCTOR INTERVIEW QUESTIONS

Instructor Interview Questions

The interview questions will guide the direction of the instructor interviews:

1) Please describe the instructional process in your class.

2) What are a few words that describe your teaching style?

3) Why did you (or did you not) make use of Echo360?

4) Can you identify a time when Echo360 changed the way you approached class?

5) How did you use the system?

6) What changes to the system would have caused you to change your use of it?

7) Did using the system (or choosing not to use it) have an affect on the way you delivered the course material? Why?

8) How would you use the system if you had access to it in a future class?

9) What are the most effective ways for students to use the system?

10) What are the most effective ways for teachers to use the system?

11) Would you prefer to teach in a room that has this system over one that does not?

12) Can you name a time when a student indicated that Echo360 was useful or helpful?

APPENDIX D: STUDENT FOCUS GROUP CUIDING QUESTIONS

1) Why did you (or did you not) use Echo360?

2) Can you identify a time when Echo360 changed the way you approached class?

3) How did you use the system?

4) What changes to the system would have caused you to change your use of it?

5) Did using the system (or choosing not to use it) have an affect on your learning of the course material? Why?

6) How would you use the system if you had access to it in a future class?

7) What are the most effective ways for students to use the system?

8) What are the most effective ways for teachers to use the system?

9) Would you prefer to take a class that uses this system over one that does not?

APPENDIX E: STUDENT SURVEYS

Echo Fall 2015 Pre Semester Survey

The following survey is designed to measure your experiences in a class that used the Echo360 Active Learning Platform. The Active Learning Platform is a combination of a lecture capture tool, which allows you to watch recorded videos of the class, and the student engagement tool, which gives you access to interactive lecture slides. Your response to the following questions will remain anonymous. Your name will only be known to the primary researcher, and it will be coded and removed from all compiled data. You will not be identified in any publication related to this study. Your honest responses will help advance our understanding of how technology affects the student experience, and it will help the university make wise decisions about what technologies should be used on campus.

In this section, we'll ask some questions about your level of engagement a typical college class. Please answer these questions only as they pertain to your engagement in a typical college class. Answer honestly; remember: all of the compiled data will be anonymized.

In the following questions, indicate the extent to which the following thoughts, behaviors, and feelings describe you in a typical college course. In responding, indicate how characteristic each of the prompts are to your typical behavior in a typical college class. If this is your first semester in college, indicate how characteristic each of the prompts are to your typical behavior in a typical academic class. Please rate each item on the following scale: 5 = very characteristic of me; 4 = characteristic of me; 3 = moderately characteristic of me; 2 = not really characteristic of me; 1 = not at all characteristic of me.

In a typical college class...
_____ I raise my hand in class (1)
_____ I participate actively in small groups (2)
_____ I ask questions when I don't understand the instructor (3)
_____ I do all my homework (4)
_____ I come to class every day (5)
_____ I go to the professor's office hours to review assignments or tests, or to ask questions (6)
_____ I think about this course between class meetings (7)
_____ I find ways to make the course interesting to me (8)

In a typical college class...
_____ I take good notes in class (1)
_____ I look over my notes between classes to make sure I understand the material (2)
_____ I desire to learn the course material (3)
_____ I am confident that I can learn and do well in the class (4)
_____ I put forth effort (5)
_____ I am organized (6)
_____ I am getting a good grade (7)
_____ I do well on the tests (8)

In a typical college class...
_____ I stay caught up on the readings (1)
_____ I have fun in class (2)
_____ I help my fellow students (3)
_____ I make sure to study on a regular basis (4)
_____ I find ways to make the course material relevant to my life (5)
_____ I apply course material to my life (6)
_____ I listen carefully in class (7)

Finally, we'll collect some information about you.

Name

Sex

Age

Your current cumulative grade point average (GPA)
_____ Slide the bar to indicate your current GPA. (1)

Your declared course of study at UNL
Major (1)
Minor (2)

Is this class required for you declared major or minor?
❍ yes (1)
❍ No (2)

Echo Fall 2015 Test Group Master Post Semester

The following survey is designed to measure your experiences in a class that used the Echo360 Active Learning Platform. The Active Learning Platform is a combination of a lecture capture tool, which allows you to watch recorded videos of the class, and the student engagement tool, which gives you access to interactive lecture slides. Your response to the following questions will remain anonymous. Your name will only be known to the primary researcher, and it will be coded and removed from all compiled data. You will not be identified in any publication related to this study. Your honest responses will help advance our understanding of how technology affects the student experience, and it will help the university make wise decisions about what technologies should be used on campus.

First we'll ask some questions about Echo360 lecture capture. This system recorded the live class sessions and allowed you to re-watch the classes online. Your instructor may have required that you use the system for assignments or may have made using it optional.

Q1 Have you viewed recorded lectures for this class using the Echo 360 lecture capture system?

- ❍ Yes (9)
- ❍ No (10)

If No Is Selected, Then Skip To End of Block

Q2 How many times did you use Echo 360 to view recorded classes?

If I did not use the system Is Selected, Then Skip To End of Block

Q3 What is the primary reason you viewed recordings of this class?

- ❍ Viewing the recordings was a required element of the class (1)
- ❍ I missed class and wanted to see the material (2)
- ❍ There was a portion of the material I did not understand and wanted to review (3)
- ❍ My notes were incomplete (4)
- ❍ I was studying for a test (5)
- ❍ Other (please describe) (6) _____

Q4 What other reasons motivated you to view recordings of this class? You may select more than one response for this question.

- ❑ No other reasons (1)

Q5 Rate the degree to which you agree with the following statements:
_____ Lecture Capture, such as Echo 360, is easy to use (1)
_____ I can learn more in a class that records class than in classes that don't (2)
_____ Given a choice, I would prefer to take a class that records classes than a class that does not (3)
_____ The university should invest in installing class recording systems in more classrooms (4)

If No, then ask

Q2a You indicated you did not use the Echo360 lecture capture system. Please tell us why you did not use it.

- ❍ I was not required to use it (1)
- ❍ The instructor did not mention it or make use of it (2)
- ❍ I didn't think the system would help me in class (4)
- ❍ Other (please explain) (3) _____

This section will ask questions pertaining to the student engagement tool in the Active Learning Platform. With this tool, your instructor may have given you access to lecture slides for note-taking and discussion, used interactive quizzes, or conducted polls or surveys.

Q6 Have you used the student engagement tools such as interactive lecture slides, interactive quizzes, or in-class surveys or polls?

- ❍ Yes (9)
- ❍ No (10)

If No Is Selected, Then Skip To End of Block

Q7 How many times did you use the student engagement tools in this class?

Q8 What is the primary reason you used the student engagement tools in this class?

- ❍ Using the system was a required element of the class (1)
- ❍ I wanted to take digital notes (2)
- ❍ I wanted to ask questions/engage in discussions in the system (3)
- ❍ My instructor used the system for quizzes or polls (4)
- ❍ I was studying for a test (5)
- ❍ I used the system to help with homework or assignments (7)
- ❍ Other (please describe) (6) _____

Q9 What other reasons motivated you to use the student engagement tools in this class? You may select more than one response for this question.

- ❑ No other reasons (1)

Q10 Rate the degree to which you agree with the following statements:
_____ The student engagement tools is easy to use (1)
_____ I can learn more in a class that uses the student engagement tools in classes that don't (2)
_____ Given a choice, I would prefer to take a class that uses the student engagement tools over one that does not (3)
_____ The university should invest in student engagement tools in more classrooms (4)

If No, then ask:
Q10a You indicated you did not use the student engagement tools. Please tell us why you did not use it.

- ❍ I was not required to use it (4)
- ❍ My instructor did not use the system (1)
- ❍ I didn't think it would help me in class (2)
- ❍ Other (please explain) (3) _____

The next three questions ask about your general impressions of the Echo360 Active Learning Platform systems used in this class. Remember, the Echo360 Active Learning Platform is comprised of the Lecture Capture tools and the Student Engagement tools.

Q11 In thinking about the Active Learning Platform, in what ways do you think it enhanced your learning or changed the way you approached this class?

Q12 In thinking about the Active Learning Platform, are there ways you think it could be improved or used in a more effective way?

Q13 Please provide any additional comments about the Active Learning Platform used in this class.

In this section, we'll ask some questions about your level of engagement in this class. Please answer these questions only as they pertain to your engagement in this class. Answer honestly; remember: all of the compiled data will be anonymized.

In the following questions, indicate the extent to which the following thoughts, behaviors, and feelings describe you in this course. Please rate each item on the following scale: 5 = very characteristic of me; 4 = characteristic of me; 3 = moderately characteristic of me; 2 = not really characteristic of me; 1 = not at all characteristic of me.

Q14 5 = very characteristic of me; 4 = characteristic of me; 3 = moderately characteristic of me; 2 = not really characteristic of me; 1 = not at all characteristic of me. In this class...

_____ I raise my hand in class (1)
_____ I participate actively in small groups (2)
_____ I ask questions when I don't understand the instructor (3)
_____ I do all my homework (4)
_____ I come to class every day (5)
_____ I go to the professor's office hours to review assignments or tests, or to ask questions (6)
_____ I think about this course between class meetings (7)
_____ I find ways to make the course interesting to me (8)

Q15 5 = very characteristic of me; 4 = characteristic of me; 3 = moderately characteristic of me; 2 = not really characteristic of me; 1 = not at all characteristic of me. In this class...

_____ I take good notes in class (1)
_____ I look over my notes between classes to make sure I understand the material (2)
_____ I desire to learn the course material (3)
_____ I am confident that I can learn and do well in the class (4)
_____ I put forth effort (5)
_____ I am organized (6)
_____ I am getting a good grade (7)
_____ I do well on the tests (8)

Q16 5 = very characteristic of me; 4 = characteristic of me; 3 = moderately characteristic of me; 2 = not really characteristic of me; 1 = not at all characteristic of me. In this class...

_____ I stay caught up on the readings (1)
_____ I have fun in class (2)
_____ I help my fellow students (3)
_____ I make sure to study on a regular basis (4)
_____ I find ways to make the course material relevant to my life (5)
_____ I apply course material to my life (6)
_____ I listen carefully in class (7)

Finally, we'll collect some information about you.

Name

Sex

Age

Your current cumulative grade point average (GPA)
_____ Slide the bar to indicate your current GPA. (1)

Your declared course of study at UNL

Is this class required for you declared major or minor?

How many times were you absent from a physical class session of this class this semester?

Would you be interested in participating in a focus group to discuss your experience in this class?

Echo Fall 2015 Comparison Group Master Post Semester

The following survey is designed to measure your engagement in college classes. The data collected for this study will not affect your standing or grades in any of your classes. The information collected will help educational researchers at UNL understand the motivation and engagement patterns of students in large lecture classes on this campus. Your response to the following questions will remain anonymous. Your name will only be known to the primary researcher, and it will be coded and removed from all compiled data. You will not be identified in any publication related to this study. Your honest responses will help advance our understanding of how technology affects the student experience, and it will help the university make wise decisions about what technologies should be used on campus.

In this section, we'll ask some questions about your level of engagement in this class. Please answer these questions only as they pertain to your engagement in this class. Answer honestly; remember: all of the compiled data will be anonymized.

In the following questions, indicate the extent to which the following thoughts, behaviors, and feelings describe you in this course. Please rate each item on the following scale: 5 = very characteristic of me; 4 = characteristic of me; 3 = moderately characteristic of me; 2 = not really characteristic of me; 1 = not at all characteristic of me.

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Finally, we'll collect some information about you.

Name

Sex

Age

Your current cumulative grade point average (GPA)
_____ Slide the bar to indicate your current GPA. (1)

Your declared course of study at UNL

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Would you be interested in participating in a focus group to discuss your experience in this class?

APPENDIX F: RECRUITING SCRIPT

Recruiting Script

Hello, my name is Jeremy Van Hof. I am a graduate student at UNL, pursing my Ph.D. in Instructional Technology. I am conducting research on lecture capture technology, hoping to find out if the use of this technology affects learning outcomes. Lecture capture technology is any technology that creates a recording of a class's lecture and other activities and makes that recording available for students to view at a later date. The lecture capture system used in this study uses technology from a vendor called Echo 360. The Echo 360 system will capture (record) a video feed of the classroom, an audio feed of the classroom, and any digital materials displayed on the instructor computer (e.g. a PowerPoint presentation or a document camera). The recording is processed on a digital recording device housed in the classroom, then sent via the Internet to Echo 360's cloud server. Once processed - usually about an hour after the conclusion of the class - the capture becomes available to you and your instructor via the 'Echo Center' - a utility installed in Blackboard that serves as a video player for the captures. Only students enrolled in this class can access the captures made for this class in the Echo Center. The Echo Viewer allows you to bookmark key points, post questions for other students or the instructor, and move quickly from section to section within the capture. The Echo Center allows instructors to view viewing statistics, including the time each student spent viewing a capture and the frequency that certain sections of the capture were viewed.

Lecture Capture technology is not new. It has been used for years as an instructional tool by teachers looking for a way to archive the proceedings of a class in order to re-view the content at a later date. However, there is no clear consensus in the existing literature on the question of whether or not lecture capture actually improves student learning outcomes.

If you agree to be part of the research study, you will be asked to complete two surveys – one in March of 2014 and one in May of 2014. These surveys will ask you to report your name, age and sex. Additionally, you will be asked to disclose your current GPA and your area of study at UNL. The majority of the survey questions will ask you to report your experiences in math classes in general, your experiences in this specific math class, and your experiences using the Echo 360 system. You will also grant your instructor permission to disclose tom me your scores on class tests and in the class overall. You participation in the study is optional. Even if you don’t participate you’ll still have access to the recorded class sessions.

If you have any questions I can be reached at 402-472-4266.